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OUR NATIONAL GAME.

ROBERT FERGUSON, Monmouth's follower, used to say:—"Let me make the ballads of my country, and I care not who makes the laws." In like manner it might be said that sports and pastimes are factors as important in the making of a people as their more serious avocations. Wellington, we know, considered that Eton—that is football, and cricket, and school sports generally—made the fighting men of England, with a reservation in favour of fox-hunting as making our British cavalry; and, although there are pursuits better befitting the dignity of man (outside the savage state) than fighting, Wellington there, speaking of what he understood best, expressed the general truth, that the sports of a race largely influence their character as a people. We may therefore fitly take for a subject of inquiry, even in a magazine chiefly devoted to science and art, a game which, like cricket, is essentially the national game of England, and—except in America—of English-speaking races.

Cricket deserves, it seems to us, the position it holds as a national sport, though chiefly for reasons which perhaps the most ardent cricketers leave out of account. Considered with regard to the amount and kind of exercise it involves, cricket is open to many objections; while the kind of skill which constant cricketing practice engenders is not exceptionally serviceable in ordinary life. Americans maintain, indeed, that, regarded as a scientific sport, base-ball is superior to cricket—about which view, knowing base-ball only from without, not from actual practice of the game, the writer can hardly venture an opinion. Certainly, if all that is said of base-ball be true, some parts of the game—pitching for instance*—must require an enormous amount of practice, and thus to acquire something of a scientific character. But, apart from any comparison between cricket and base-ball, it is certain that skill in driving, cutting, drawing, and so forth (or such skill in placing the ball as W. G. Grace and a few other players possess in marked degree), the mastery of various bowling devices, and quickness and correctness in the field or behind the wicket, are acquisitions of very little real value in life, while the quickness of eye and limb which these cricketing qualities indicate, might be acquired in others ways more directly advantageous. Again, the exercise obtained in the cricket field is intermittent and uncertain, and of doubtful value in developing muscle and expanding the chest (so, at least, says the writer of "How to Get Strong," in KNOWLEDGE, No. 35). But while in such points as these, cricket, delightful and fascinating though it is to players and bystanders alike, is imperfect as an exercise, as a sport it has qualities which render it exceedingly valuable. It is better morally than physically. The good cricketer has constantly to put self on one side. He has to keep the interests of The Eleven, not of Number One, continually before him. Even the most brilliant bat has, in the interests of his side, to exercise self-control, not only in reference to his partner at the moment, but to the whole progress of the innings so long as he is at the wickets. Bowlers must do their work as the captain directs, the captain must direct their work, or take part in it himself, as is best for his eleven, not as may best suit himself. The field must work together in due subservience to the captain's plans. And while thus men are taught discipline, self-control, and self-sacrifice (where need is), they are taught also moderation in times of prosperity, caution in times of difficulty, courage and resolution when defeat seems to stare them in the face. But defeat also has its good influence; and the cricketer who takes defeat pleasantly, not making false excuses for obvious shortcomings, but resolving hereafter to correct them, not angry with the victors, but determined to face them again as resolutely as ever, and perhaps with better success, has gone through a moral exercise which cannot but be of service to his character as a man. It is in this way, and not from any special value which cricket has as a physical exercise, that the discipline of the cricket-field tells on the character of a nation. When we consider that (outside absolute pauperdom) there is probably not one able-bodied man in ten thousand in this country who has not at some time in his life played in the cricket-field, the importance of the game as our chief national sport will be fully recognised.

Yet, we must confess, it appears to us that of late—during the last quarter of a century, perhaps—cricket has taken a position not altogether desirable. When, in former times, professional cricketers almost invariably defeated amateurs (we reject the utterly ill-chosen names Players and Gentlemen), things were more nearly as they should be, we take it, than they are now, when men who are to be lawyers, doctors, clergymen, statesmen, and so forth, give so much time to cricket during their younger days, as to acquire a skill rivalling and surpassing that of men who get a large part of their living from the practice of the game. We doubt even whether the devotion of so much time to cricket is not mischievous from the mere loss of opportunities for other games—cricket being decidedly imperfect as the sole or chief form of exercise. But it is a much more serious question how far study, and even mental development, are influenced by the excessive devotion to cricket which is now found not only at great public schools but all over the country. It may seem at a first view as though only a few were affected in this way; for people hear only of the few at each public school, or at the universities, or the like, who acquire very great proficiency in batting, bowling, and fielding. But those who come near the best, and those who, just because they have never had any chance of coming near the best, have given more time to vain efforts than a Steel or a Studd to successful practice

* It is said, and we have been assured by American men of science that it is truly said, that a good "pitcher" can cause the ball to change its course when in the air, so intense is the "spin" he can give to it!

XUM

—make up a very large number. And the question arises whether, even in the case of those who can afford so much time during the years when they should be fitting themselves for the duties of life, the game is altogether worth the sacrifice made for it. Cricket was a splendid game, though not so generally well played, when a strong and clever lad, working at his books and studies, could gain enough skill with the bat or ball, or both, to take a good place in his school or college eleven. But now, when we see Marlborough turning out a Steel, Rugby a Leslie, and so forth, who, almost from the day of leaving school, are good enough to play in a representative eleven of All England, it is tolerably evident that the standard of school cricket is too high to be reached, or even approached, without much more time being devoted to the game than perhaps the wiser lads themselves, and certainly the parents, should altogether desire. "All work and no play" is as bad as "All play and no work;" but "too much play and too little work," too much Studd and too little Study, must have mischievous effects in the long run; and unless we misjudge all that we have heard on such matters, a very strong impression begins to be entertained in certain quarters (chiefly, but not wholly, parental) that this is so.

Yet of cricket, as a school or college game, we have a far higher opinion than of cricket as developed in our great three days' matches. Here all the faults of cricket are exaggerated. It is always full of uncertainty; the ball which takes a wicket may come early or late, a few steps to right or to left in taking up his place may enable a fielder just to reach a catch or cause him just to miss it, and so forth *ad infinitum*. But the chance and uncertainty inevitable in cricket are increased by uncertainties of weather (affecting the condition of the ground), by luck as to time of going in (who has not seen three or four of the best men lose their wickets when a side has had to go in during the last half-hour or so of bad and uncertain light), and by other causes, not necessarily belonging to the game, though made to do so by laws as unchangeable as (and as unreasonable as some of) the laws of the Medes and Persians? Then how many matches end in a draw? Three of the most interesting during the last fortnight (Australians and Marylebone, Australians and Yorkshire, and Eton and Harrow)[1] have so ended. It is, indeed, especially unsatisfactory that every game except one, in which the Australians seemed to have met their match this season, has ended in a draw. How many games, again, are finished long before the allotted time is up, to the annoyance of spectators and to the loss of many worthy professional cricketers?

These defects, at any rate, might easily be corrected. We shall sketch in our next a plan (which will certainly never be followed, but that does not matter) by which no game would ever end in a draw, or need ever be finished till within half-an-hour or so of the end of "time;" by which both sides would play under equal conditions as to weather, hour, state of ground, and so forth; by which the men of neither eleven would be kept idling about, as often happens now, for a whole day—while yet a match played out to the two full innings would be played under precisely the same cricketing conditions as at present, and a match completed in less than two innings, or requiring more than two innings to fill the three days, would still be played under normal cricketing conditions during the whole time that it continued.

[1] THE Princess Beatrice has forwarded a handsome present to the Free Library, London-street, Bethnal-green, E. The University of Oxford and the Lords Commissioners of the Admiralty have made large grants of their publications to the above institution, which is supported entirely by voluntary contributions.

FOUND LINKS.

BY DR. ANDREW WILSON, F.R.S.E., F.L.S.

(*Concluding Paper.*)

I PURPOSE in this concluding article to direct attention to the very interesting, and at the same time astonishing, facts in favour of evolution which recent researches amongst extinct and fossil *Mammalia* (or Quadrupeds) have brought to light. The quadruped class presents us with a large and varied array of animal forms; and it is therefore needful that at the outset we should endeavour to gain some plain ideas respecting the arrangement of the class into "orders." These latter are the subordinate groups into which every "class" of animals is primarily divided. To begin with, the quadrupeds themselves, as a class, are capable of being divided into two distinct series. Of these, the first, as mentioned in a previous paper, contains the kangaroos, wambats, opossums, and their neighbours, along with the *Ornithorhynchus*, or duck-billed water-mole of Australia, and its near neighbour, the *Echidna*. These animals form collectively a division, which may be named that of "Lower Mammals," inasmuch as, in respect of many points in their anatomy, they exhibit a decided inferiority to our common quadrupeds, and to the other members of the class. All other quadrupeds may be named "Higher Mammals," since they exhibit among themselves an agreement in structure which places them above the kangaroos and their kith and kin. Tabulating the great class of quadrupeds, we find that the following arrangement gives a brief sketch at once of the characters of the various "orders," and their chief representatives.

Order the first is called the *Monotremata*. It includes the Ornithorhynchus and Echidna, both denizens of the Australian region. These animals exhibit bird-like characters, as has been shown in a previous paper. They possess "Marsupial bones," like the kangaroo races; and in many respects present us with a peculiar and special, but still low type of quadrupeds. The second order is that of the *Marsupialia*. These are the kangaroos, wombats, phalengers, and opossums; the latter alone being found outside the bounds of the Australian province. Here the bird-characters have disappeared, although the included animals are of low structure as compared with such forms as the dogs, horses, seals, &c., of higher orders. The "Marsupials," as their name implies, usually possess a "pouch," supported on the "marsupial bones" that rise from the front of the haunch (see KNOWLEDGE, page 532, Vol. I.). Even if the "pouch" itself be wanting (as in some opossums), the bones supporting it are developed.

The Higher Mammals introduce us to order the third, that of the *Cetacea*, or Whales. A fish-like body, one fully-developed pair of limbs (the fore limbs) assisting in the shape of swimming-paddles, a horizontal tail-fin, and nostrils forming "blow-holes," are the characters of which the whales, dolphins, porpoises, and the like are characterised. The fourth order is that of the *Sirenia*, represented by two genera of animals—the Manatees, or Sea Cows and Dugongs—long classified with the whales. Here the body is again fish-like, and the fore limbs, which are alone developed, form swimming-paddles; but the nostrils do not form "blow-holes," and the skin is sparsely covered with bristles. The *Edentata*, or Ant-eaters, Armadillos, Sloths, and Pangolins constitute the fifth order, whose head-quarters exist in South America. There is only a single set of teeth in these animals, and the teeth are further destitute of distinct roots, whilst they want enamel. Scales or bony plates, as in the Armadillos, often cover the body.

An order of immense extent, that of the *Ungulata*, or "hoofed" quadrupeds, forms the sixth division. Here the largely-developed nails, called "hoofs," are met with, and all four limbs are always developed. The rhinoceroses, horses, pigs, ruminant animals (sheep, deer, oxen, camels, &c.), hippopotamus, &c., represent this group. The seventh division is that of the elephants (*Proboscidea*), the characters of these animals requiring no special mention. The hyrax, or "coney" of scripture, represents the eighth group, and resembles the rodents or "gnawers" in some respects, whilst it is also allied to the rhinoceroses, if the form and structure of the molar or grinding teeth are considered. The *Carnivora*, or lions, tigers, wolves, dogs, bears, seals and walrus succeed, as order the ninth; and the *Rodents*, or gnawers, with chisel-shaped front teeth, growing from permanent pulps, and represented by the rats, mice, beavers, squirrels, porcupines, &c., form the tenth division. The bats, or *Cheiroptera*, with an elongated hand of four fingers (and a short thumb), adapted to support a flying-membrane, form the eleventh group. The *Insectivora* are the twelfth order, and present us with the moles, shrews, and hedgehogs as types. The *Primates* (including the *Quadrumana*, or monkeys, and *Bimana*, or man) bring us at once to the concluding order, and to the height of animal development.

(To be Continued.)

STIMULANTS AND STUDY.

BY THE EDITOR.

MR. ARTHUR READE, described in *Les Mondes* as author of the *Litterary Soudth*, has recently elicited from my esteemed friend, M. l'Abbé Moigno, certain useful notes about the habits suitable for literary or scientific workers. Mr. Reade had remarked that men of letters are commonly supposed to sustain themselves by stimulants. It is to be feared, he says*, that fifty years ago there was somewhat too close a connection between stimulants and literature; but since then the habits of men of letters have, fortunately, undergone great changes. The inveterate smokers and wine-bibbers no longer exist; six bottle men have become as rare as the dodo. Still the question remains, are stimulants a useful auxiliary to intellectual work? The opinions of medical men as to the use of wine are too diverse to have much effect. Nor are they in much better agreement as to tobacco. That tobacco is a poison is certain; so are many things we use, not only in medicine, but in food. The influence of tobacco on brainwork has been the subject of interminable controversy, and the question has occupied all classes of society. One argument is that smoke helps men to think (to dream, rather), and it is asserted that the journalist smokes in writing, the man of science in solving a problem, the artist in painting, the clergyman in composing his sermon; that, in fact, every man great in science, in literature, in arts, climbs the ladder of fame with a pipe or a cigar in his mouth. Tennyson has composed, it is said, his sweetest idylls under the influence of nicotine. Carlyle has taught the world philosophy, smoking. Not the young only have these ideas. According to Andrew, Moltke is a great snuff-taker, and it was due to snuff (*la prise aurait tout fait*) that Napoleon was so pitilessly expelled from Belgium. Mr. John C. Murray, in his volume on smoking, undertakes to show when it is dangerous, neutral, or beneficial to smoke. He claims that Raleigh, Milton, Dryden, Newton, Picot (*sic*), Steel, Addison, Swift, Congreve, Bolingbroke, Pope, Johnson, Byron, Burns, Scott, Campbell, Moore, Dickens, spoke, wrote, and sang under the influence of *coffee*, that plant of mystic power. But for those who have recourse to tobacco, he adds, their genius is generally but a lightning-flash or a meteor, involving too great mental tension, likely to drag reason from her throne and plunge it in the night of chaos. (By my troth, these are very bitter words.) Another medical authority says that a moderate use of tobacco is as necessary to the brain-worker as moderation in the use of alcohol.

On the other hand, the adversaries of tobacco regard the idea that smoking helps sound thought as a most mischievous delusion; they maintain, on the contrary, that it renders men incapable of intellectual labours. Tobacco leads to physical and mental indolence.

Mr. Reade considers that the use of stimulants is a subject which should be examined in the light of the experience of poets, artists, journalists, men of science, authors, &c., in Europe and America.

M. l'Abbé Moigno makes the following remarks in reply to Mr. Arthur Reade's questions:—

"Though I cannot offer myself as an example, because my temperament is too exceptional, my experience may have some degree of usefulness.

"I have published already a hundred and fifty volumes, small and great; I scarcely ever leave my work-table; I never take walking exercise; yet I have not yet experienced any trace of headache, or brain-weariness, or constipation, or any form of urinary trouble, &c., &c.

"Never, in order to work, or to obtain my full clearness of mind, have I had occasion to take recourse to stimulants, or coffee, or alcohol, or tobacco, &c.; on the contrary, in my case, stimulants excite abnormal vibrations in the brain, unfavourable to its prompt and steady action (*exercice regulier*).

"Often during my life I have fallen into the habit of taking snuff. It is a fatal practice; foul to begin with, since it puts a cautery to the nose, filth in the pocket (*un fumier dans la poche*); unwholesome also; for he who takes snuff finds each morning his nose stopped up, his breathing difficult, his voice raucous or with a nasal twang, because the action of tobacco is, in reality, to draw humours to the brain; lastly, unfortunate (*néfaste*), because the use of snuff gradually destroys the memory,—this last effect being for me completely proved by my own experience and that of many others."

Abbé Moigno then gives the proof that—in this form, at any rate—tobacco injures the brain, but the account, which is too long to be given here in full, and too interesting to be abridged, must be reserved till next week, when we shall give it, along with his most remarkable experience of the effect of a wise *régime* on his powers and on his health. We believe all our readers will be interested to learn how this veteran scientific worker has accomplished his long-continued and arduous labours, while yet retaining not only good but wonderful health.

(To be continued.)

* What follows, up to Abbé Moigno's communication, is partly an abstract, partly a translation, of the version of Mr. Reade's communication given in *Les Mondes*.

HOW TO GET STRONG.

FROM a much-valued correspondent, the following letter has been received through the Editor:—

"Before you leave the subject of chest expansion, I think it worth while to notice what has been vouched for by too many persons from personal experience to be dismissed

as paradoxical merely because it looks so. Within the last dozen years there have been a multitude of letters from time to time in the *English Mechanic* and some other periodicals, from persons of all ages, including some medical men, describing the benefits which they or their friends have received from what is commonly denounced as tight-lacing, but which may mean very different things, according as it is used to confine the chest or to expand it by contracting only the waist proper, which really is the stomach. I remember that drill-sergeants used to tell us at school to 'draw in the *stummick*, and throw back the sh*ou*lders' (pronounced not like *shou* but *how*).

"The two points insisted on by those who have gone into particulars are that the chest or upper ribs should not be confined at all, and that when stays are worn (not a mere belt) they should be even larger than the natural size at the top; and secondly, that the busk or plate in front should be quite stiff, of either steel or wood, and as long as will lie flat when laced up—which it is said that our ancestors understood better than we do. Several of the writers have said that this sometimes makes the difference between causing and curing indigestion, and that the sensation of a perfectly stiff busk at once convinces you that it is the right thing.

"One or two of them say that they find this treatment for only the first few hours of the morning sufficient for the improvement of their health and strength in standing and walking, and the permanent expansion of the chest quite as much as their waist has been permanently reduced; and in some cases for reducing corpulence, which is a kind of indigestion, and often a beginning of general weakness.

"These statements have been sometimes denounced by medical and other philosophers, who think they know what 'must be' better than those who have personal experience of what is, or is not. The philosophers certainly got the worst of it in all the discussions that I have read. And I am inclined to agree with the opinion that there must have been some better reason than mere vanity for the constant revival of this fashion or practice in every civilised country after many temporary declines of it during the last 1,000 years. And from my own observation I am convinced that, for every person who has ever been injured by excessive contraction of the waist (as, of course, some have), at least a hundred suffer from undue expansion of it, and from stooping and contraction of the chest, which judicious tight-lacing would prevent, and often does prevent, as at least some doctors have written.

"An Observer."

When we consider that undue expansion of the waist implies, in reality, a diseased, because abnormal, condition of this part of the body, it is not perhaps to be wondered at that an abnormal remedy, like the modified "lacing," described by "An Observer," should in some cases produce good effects. We would not recommend one who wished to obtain strong and symmetrical legs to use crutches; yet, the use of crutches may produce a marked improvement in the case of a person, who, having diseased limbs, has for a long while injured himself by using them without artificial support. Remembering, however, how the abdomen moves in normal breathing, we should say lacing must in every case act injuriously on respiration. Women can in that respect stand lacing better than men, for with them the bosom rises and falls in breathing, whereas with men the abdomen moves, at least in normal masculine breathing.

I know several who have tried lacing, on the strength of the correspondence referred to by "An Observer," without any of the good effects described, and with some markedly bad effects—especially one, a threatening sense of fullness in the head.

Some correspondents write to ask how such a construction as was illustrated in No. 36 can be arranged. We wish it to be understood that in no case do we suggest the construction of special apparatus. We only meant our picture to illustrate the kind of exercise to be taken for carrying the arms well over the head, with suitable "hauling" work. A couple of stout hooks fixed in the wall, or two rings fastened to stout nails, or any such contrivance which would suit the room or the wall, would serve to carry the cords which bear the weights. And for the weights, almost anything can be used—a couple of pretty heavy volumes, dumb-bells, clubs, or anything giving about the right kind of work in hauling. Nor is it necessary to have the middle bar, or stick. A stout cord flung over the middle of the horizontal part of the rope will give the required hold for the bell-pulling action. Or, almost all apparatus may be got rid of by hanging two "extensors" of vulcanised india-rubber to two pretty high nails, and hauling on them, either one in each hand (the hands well apart), or holding both together, as in pulling at a bell rope. In all these cases it is a great point to be ready to devise and use rough-and-ready contrivances—not to find, in the absence of pulleys or framework, an excuse for shirking some useful exercise.

With these notes, this week, we must be content. In another paper or two, the chest-expanding exercises will be done with, and then we shall proceed to consider exercises for strengthening arms, legs, &c., and giving symmetry to the various muscles of the trunk, which is of far greater importance to ninety-nine out of a hundred, than the exceptional development of particular muscles.

(To be continued.)

PHOTOGRAPHY FOR AMATEURS.

By A. Brothers, F.R.A.S.

PART XI.

THE ability to take a photograph does not make the photographer an artist, and considered artistically, a collection of amateur photographs is sometimes not very satisfactory. The reason is not far to seek. The eye is attracted by a beautiful scene; the camera is at once placed; the miniature picture visible on the ground glass is charming in the extreme, and forthwith a plate is exposed. Possibly the camera is placed in the middle of a road, and the result on developing the plate is converging lines, leading to beautiful scenery, and a wonderful expanse of uninteresting road, with not a single object to vary the lines. However beautiful the scene may appear to the eye, consider carefully what is required to form a picture, and it may be possible, by changing the point of view, so to arrange the lines that the foreground will be made to form an important part of the picture as it ought to be. The change of position, by a few yards only, makes all the difference between a bad and a good picture. If figures are introduced, they should be made to appear to belong to the scene, and not interested in having their portraits taken. It is seldom advisable that a figure should be turned towards the camera. The straight lines of hedges and fences crossing the picture horizontally should be avoided as much as possible.

Another very important matter to observe is, that the principal object in the view should not, as a rule, occupy the *centre* of the picture. Much may be learned by studying the arrangement of lines in pictures and engravings.

XUM

It will seldom be found that a tree, a figure, or other prominent object, is placed centrally. But there are exceptions to this rule, which need not be considered here.

The use of the quick gelatine plates makes it possible to introduce cattle into the foregrounds of photographs, and these, if fortunately placed, make a most valuable adjunct, and considerably enhance the artistic value of the result.

For distant views, wide-angle lenses should not be used; the effect is to dwarf distant objects. The natural angle of vision is about 60 degrees; therefore, if much more of the subject be included, it cannot have an appearance true to nature. Such lenses are valuable for near views, as they enable us to bring into the picture points which assist to make it more complete; and the defect visible in distant views taken with such a lens is not apparent in the near view.

The beautiful atmospheric effects often seen in nature when there is a slight haze over the distant landscape, from an artistic point of view, is one of the most charming aspects of nature; but, unfortunately, is not always suitable for photography. The distant hills just visible through the haze may not be visible in the photograph, and we have only the foreground and mid-distance. On the other hand, the effect in a photograph is not good when the distance is as clearly defined as the foreground. Unfortunately, the amateur cannot always choose his light or time of day for taking his views. He is possibly merely passing through the scenery, and he must take just what he happens to see at the time; therefore, it must very frequently happen that a good picture comes by chance, and the majority of photographs are only of interest as records of what happened to be the effect at the instant the view was taken.

The charming photographs one sees occasionally are usually the result of much patient waiting. It often occurs that the best view of a place can only be obtained at a certain time of the day, and to obtain that view it may be necessary to wait many days so as to catch nature just at the favourable moment—the result may be worth all the waiting.

In photographing buildings (or any other object indeed) care should be taken that the camera be level. This can be done with sufficient accuracy by the eye, and to avoid too much foreground the lens may be lifted by the sliding front. When the camera is provided with a swing back, the defect arising from having to raise or depress the camera may be obviated.

In taking views it not unfrequently happens that the sun may be shining directly into the lens. Such being the case, the greatest care must be taken to shield the lens in some way, or the plate will certainly be fogged.

The most usual plan for carrying plates is to have a number of dark slides, each made to hold two plates, which, of course, must be numbered, or a changing box or bag may be used; and it is necessary, therefore, to be extremely careful to avoid exposing the same plate twice. This occasionally happens, and it is a source of serious disappointment. In order to avoid failure in this way, a book should be provided in which a record should be kept of each plate, stating number of plate, subject, time of day, the size of stop (or diaphragm), the lens used, and time of exposure.

We must not omit a few words about instantaneous photography. If really instantaneous effects are required, some kind of mechanical shutter must be used, and these can be had in a variety of forms. One of the most simple is a slide with an adjustable aperture, which is arranged to fall in front of the lens, on being released at the required instant. The time of the exposure can be regulated by the length of the aperture. Some very good effects may be obtained by merely using the hand to remove the cap of the lens, care being of course taken not to shake the camera.

FAIRY RINGS.*

> You demi-puppets, that
> By moonshine do the green sour ringlets make,
> Whereof the ewe not bites.

SCIENCE has been scarcely more explicit than Shakespeare concerning the identification of these mysterious demi-puppets, although many attempts at explanation have been made. In spite of this, I have a theory of my own, which, halting though it be, I here expound.

I occupied during a few years a house on the slope of the Hope Mountain, near Caergwrle, in Flintshire. The house is named "Celyn" in the Ordnance maps. It commands a fine view of the Alyn valley and country beyond. The most conspicuous of the pasture fields displayed below had no fairy rings during the first and second years of my residence in the Celyn: but on the third a large crop of them came into existence. They were arranged in orderly rows, and so conspicuous that they forced themselves continuously on my attention—were, in fact, almost irritating by their persistent appeals for explanation. They worried me thus every day from the September of one year to the July of the next, excepting when the snow was on the ground.

I walked down frequently to the field and examined the troublesome things, finding them always the same—viz., nearly true circles, and composed of coarser grass than that surrounding them, and at times with a crop of small fungi dotted over them. They varied very little in size, were about six feet in diameter—too small to have been the track of any tethered animal—but they evidently had received some kind of special manuring.

Suddenly, on one bright July morning, the mystery was solved. A crop of grass had been mowed, tossed, and winnowed, and was now in cocks ready for carrying to the stack. The circumference of the base of these cocks corresponded almost accurately with that of the fairy rings; their numbers and arrangements were nearly identical; some of the cocks actually covered the area enclosed by the ringlets of the demi-puppets.

Then I remembered the history of the last year's harvest on that particular field. A weary continuance of drenching rain commenced just when the grass was cocked as now, and it remained thus on the ground for several weeks, until almost black with fungoid rotting. Here, then, was the explanation. The juices of the rotting grass had been washed down the slopes of the cocks, and with these juices were the fungus germs that "soured" the ground.

There would thus be effected a sort of special or differential manuring of circles, having outside diameters corresponding to that of the base of the cocks, and a thickness of ring equal to the depth of penetration and drainage of the rain.

The last year's history of this field was impressed on my memory by a small triumph of *dilettante* science applied to agriculture. My own grass was cut at the same time as the grass of this opposite field, and both were cocked on Friday, in splendid weather; but I had observed a steady fall of the barometer, and accordingly employed extra hands, and made a great bustle to get my hay carried on Saturday—worked till midnight—thereby amusing considerably my neighbours, who were profes-

* By W. Mattieu Williams. From the *Gentleman's Magazine*.

sional farmers. The fine weather continued through Saturday and on till Sunday night, when the rain began and continued, with the disastrous results above described.

I hope this Note may induce others to repeat my observation by looking for these fairy rings, and, when they find them, inquiring whether any kind of heap of vegetable matter formerly occupied the area included within their circuit.

THOUGHT-READING.

By the Editor.

SUPPOSING trickery eliminated by the various tests employed by Professor Barrett and his colleagues, the point to be determined would be, of course, the method by which the person questioned was led to a correct reply. It must be remembered that the necessity of guarding against trickery interfered to some degree with the prosecution of a systematic inquiry into the laws underlying the observed phenomena. It is unfortunate that in inquiries of the sort this difficulty always arises. Thus the real phenomena underlying so-called mesmerism are full of interest, and might be readily made the subject of scientific inquiry, were it not for the trickery practised by many professed mesmerists, who, to impress audiences, pretend to do what, in reality, is outside their powers. In fact, the most satisfactory experiments in mesmerism or hypnotism, or whatever we choose to call the mental phenomena involved, are actually those performed on animals, simply because animals cannot be persuaded to be tricky "subjects." That thought-reading should in like manner be tested by experiments on animals may seem a wild and fanciful idea; yet the responses of the Mastiff Kepler, described in the series of papers on "Intelligence in Animals" (Vol. I.), show that a dog may possess a power of reading his master's thoughts akin to that which, on the Thought-Reading hypothesis, is possessed by some of ourselves.

To return to Professor Barrett's inquiries:—

"We endeavoured," he says, "to gather such indications as we could of the way in which the impression flashed on the mind of the child. The first question concerns the respective parts in the phenomena played by mental *eye* and mental *ear*. Among the experiments which we counted as *failures* were very many where the number or card selected was guessed, as it were, piecemeal. For instance, the number 35 was selected, and the guesses were 45 and 43. So 57 was attempted as 47 and 45. So with cards: the seven of diamonds being chosen, the guesses were six of diamonds and seven of hearts; the three of spades being chosen, the guesses were queen of spades and three of diamonds. These cases seem somewhat in favour of mental eye, the similarity in *sound* between three and thirty in 43 and 35, or between five and fifty in 45 and 57, not being extremely strong; while the *picture* of the three or the five is identical in either pair. A stronger argument on the same side is the frequent guessing of king for knave, and *vice versâ*. On the other hand, names of approximate sound (also reckoned as failures) were often given instead of the true one; as 'Chester' for Leicester, 'Biggis' for Billings. Frogmore was guessed first as 'Freemore;' Snelgrove was given as 'Singrore,' the last part of the name was soon given as 'grover,' and the attempt was then abandoned; the child remarking afterwards that she thought of 'Snail' as the first syllable, but it had seemed to her too ridiculous. One of us has, moreover, successfully obtained from the maid-servant a German word of which she could have formed no visual image. The children's own account is usually to the effect that they 'seem to see' the thing; but this, perhaps, does not come to much, as a known object, however suggested, is sure to be instantly visualised. Another question would be as to the effect of greater or less distance between the sitters and the guesser, and of the intervention of obstacles. It will have been seen that, in the experiments conducted by one of us on a former occasion, the intervention of a door or wall seemed to make no difference. It would be interesting, again, to discover whether numerical increase in the observers increases the effect, and how far the presence of special persons is influential. In our experience the presence of the father—though by no means essential, and very often dispensed with—seems decidedly to increase the percentage of successes. A still more interesting and important question concerns such conditions of success and failure as may lie in the circumstances, disposition, general capacity, and mood of the subject, including such points as consanguinity and familiarity with members of the circle, and also in the temper and manner of the latter. We are dealing, not with chemical substances, but with childish minds, liable to be reduced to shyness and confusion by anything in the aspect or demeanour of visitors which inspires distaste or alarm. The importance of a 'childly way with children,' and the slightness of the differences of manner which will either paralyse them into stupidity or evoke unexpected intelligence and power, are commonplaces to anyone whose duties have lain among them; and attention to such points may be as prime a factor of success in these delicate experiments as any other. The delicacy of the conditions was illustrated in our own inquiry partly by the inexplicable fluctuations of success and failure affecting the whole household, partly by the wide difference observed in the capacities of particular members of it from day to day. The common notion that simplicity, and even comparative blankness of mind, are important conditions, seems somewhat doubtfully borne out by our experience; but of the favourable effect of freedom from constraint, and of a spice of pleasurable excitement, we can speak with entire assurance. The particular ill-success of a sitting which we held one close afternoon was attributed by the children themselves—and it seemed to us correctly—to inertness after their early dinner. We could find no resemblances between these phenomena and those known as *mesmeric;* inasmuch as a perfectly normal state on the part of the subject seemed our first prerequisite. Nor did we find any evidence that 'strength of will' has any particular effect, except so far as both subject and circle may exercise it in patient attention. On one or two occasions it seemed of advantage to obtain vivid simultaneous realisation of the desired word on the part of all the sitters; which is most easily effected if some one slowly and gently claps time, and all mentally summon up the word with the beats."

This last observation is significant, and if it could be confirmed by a sufficient series of experiments, would go far to establish the theory that mind can act on mind at a distance—that is, without actual contact by which mind impressions can be conveyed by a sort of unintended signalling.

On this point, and especially on the theory of brain-waves, which has been suggested in explanation of the numerous stories related of apparitions seen by friends at a distance at the time of the death of the persons so seen, or of some serious accident befalling them, we shall have a few words to say in our next.

(*To be continued.*)

MATHEMATICS AND SCIENCE.

BY THE EDITOR.

MR. W. MATTIEU WILLIAMS, in an interesting note upon the Origin of the Solar System, with special reference to my article on the "Birth of the Moon," in the *Gentleman's Magazine*, remarks (in the July number of that magazine) on the assumption, too often made, he thinks, by mathematicians, "that whatever has been demonstrated mathematically, must be infallibly true." He says very pleasantly of myself that I am as free from this form of scholastic dogmatism as any of my mathematical kind; yet, even in my case, "this mathematical self-righteousness crops out occasionally, as in the paper above-named, where, referring to Mr. Geo. Darwin, I say, "the reasoning relating to this part of Mr. Darwin's views does not belong to the sure domain of mathematics, but to speculation." "This reads oddly," proceeds Mr. Williams, "when closely following a description of how Adams, twenty years or so ago, discovered a notable flaw in Laplace's reasoning which was purely mathematical, and further, that both Leverrier and Pontécoulant have rejected (it should be "did for a while reject") Adams' results, the latter 'even denouncing Adams's method of treating the subject as analytical *legerdemain*.' All this was in 'the sure domain of mathematics' of the purest and highest order, and among mathematical giants; the difference of results was quantitive—*i.e.*, mathematical—and not a mere fractional percentage, the result obtained by Adams being 'only one-half of what Laplace had made it.' Such instances of error, to which mathematicians, like all other human beings, are ever liable, enforce the necessity of continual verification of mathematical conclusions, by comparing them with facts revealed by observation and experiment."

It appears to me that in the above passage Mr. Williams overlooks the distinction between mathematical reasoning and mathematical demonstration. A mathematical demonstration must be infallibly true, or it is not a demonstration; but mathematical methods of reasoning may lead to erroneous results—especially in problems of extreme difficulty and complexity. We do not regard the processes of addition, subtraction, multiplication, and division, as themselves unsound because they lead to incorrect results when incorrectly applied. Now, in the more difficult applications of mathematics, errors are not only more readily made than in simpler inquiries (just as mistakes are oftener made in long "sums" than in easy ones), but they affect quantitative, more readily by far than qualitative results. We may be quite sure, after our differential equations have been dealt with, that the answer is positive or that it is negative—in other words, that the physical result about which we are inquiring is of one or another kind, but we may find it very difficult, or even impossible, to determine what its exact value may be. It should be remembered that the quantity which Laplace endeavoured to estimate was itself a correction of a determination known to be approximative only. Certain terms in those with which the lunar theory has to deal had been neglected as not likely to appreciably affect the estimated motions of the moon. Laplace took them into account, and showed that they lead to a larger correction than had been supposed, and in fact account for an observed departure of the moon from her estimated course. But in dealing with them he thought he might safely omit certain dependent terms; and Adams showed, on the contrary, that these also must be considered or else the "correction" is nearly doubled. The reasoning by which he showed this, was so difficult, that Pontécoulant and Leverrier did not at first perceive its force, just as inferior mathematicians might fail to see the force of reasoning applied to the solution of ordinary problems in the Differential Calculus. They of course recognised after awhile the accuracy of Adams' reasoning, but at first they rejected it.

All this, while it shows excellently how delicate and difficult are inquiries in the higher branches of mathematics, by no means invalidates the general proposition that mathematical methods are sure and sound. On the contrary, the detection of Laplace's error shows that the processes he incorrectly applied are themselves altogether trustworthy. The use of logarithms in a long arithmetical process will lead to a correct result, if there is no mistake in the working; if an incorrect result appears, we blame the arithmetician, not the method. Albeit we cannot too cautiously test mathematically-obtained results by observation and by experiment. Now I think mathematicians deserve credit for doing this most thoroughly in astronomy. So far from dogmatising about the lunar theory, for example, they watch every movement of the moon's to see if they have worked correctly. They find out the errors resulting from the approximate, or in some cases, imperfect nature of their mathematical methods. Then again, mathematicians themselves announce the shortcomings of their methods. It was not an outsider or a non-mathematician who detected the mistakes of Laplace, and he detected it by mathematical methods, and actually against the evidence of observation—with which Laplace's results were in perfect accord.

ELECTROMANIA.

BY W. MATTIEU WILLIAMS.

PART II.

THE real practical objection to all electric lights is the cost. That has been somewhat diminished, but still remains. With the voltaic battery the electric energy is obtained by the combustion of zinc, and the consumption of zinc and other materials is exactly proportionate to the amount of electric force expended. With the dynamo machine coal is substituted for zinc, but its action is more indirect. The calorific energy supplied by combustion has first to be converted into mechanical force by means of a steam-engine, and in doing this much power is lost. Then the mechanical force is converted into magnetic and electric energy with further sacrifice. Besides the waste by dissipation of energy, there are friction and other mechanical resistance to be overcome, in addition to the magnetic and electrical resistances.

In burning coal gas the light is a direct result of combustion, the only loss of power being that which is used in the distillation of the coal and the leakage of the gas pipes. The cost of the first of these, *i.e.*, of the fuel burned under the gas retorts, is repaid with abundant profit by the tar products, and the ammonia distilled over simultaneously with the gas. So valuable have these products now become that if we were all to go to bed at sunset, and rise at dawn, so that no gas should be required either in our streets or houses, the gas-works would not therefore be abolished. They would continue the distillation of coal for the sake of the liquid products, and could do this profitably, though throwing their gas into the air, or merely burning it in huge flambeaux to light the works.

As an example of the progress that has been made in the economy of gas manufacture, I may refer to the fact that the proprietors of the original Vauxhall Gas Works were sued by the flounder fishermen of the Thames for killing the fish by pouring their "gas water" into the river. The company was thereby compelled to cart this water away at considerable expense, with continually increasing difficulty in getting rid of the nuisance. Now it is the raw material of our largely-used ammoniacal salts, and an important source of revenue to the gas companies.

An account of the gradual development of the uses of the tarry products would fill a volume, and a very interesting volume it might be made.

Besides these, we have continually progressing improvements in the methods of refining the gas, one of the more recent being the use of red iron ore dug out of Irish bogs. The burners, as everybody knows, are being continually improved, and still wait a

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further and very great improvement in the direction already indicated by Siemen's regenerative gas burner, which increases the intensity of combustion. This shortening of the radiant wave-lengths, or conversion of heat into light, is a scientific effort that really is in its infancy. The first step towards the practical solution of the problem is already made, viz., its clear theoretical statement.

The possibilities of gas-lighting must not be judged by the existing supply of London, which is disgraceful to all concerned both as regards quality and cost. This is amply proved by the experience of all those northern and midland towns that are now supplying themselves with gas. If the prevailing electromania could raise any approach to practical competition, it would be a great benefactor, but I fear that this is impossible, and know well enough that our best gas engineers thoroughly understand the impotence of their supposed rivals.

That a brilliant light far excelling that of ordinary gas-burners is easily obtainable, either by electric arc or incandescence, is indisputable. All who have worked practically and studied theoretically the subject have arrived at the same conclusion as that of Starr, King, Dorr, and myself in 1846, that the incandescent light in vacuo is the best, and that it is available for a variety of sensational and exceptional purposes—theatres, light-houses, &c.; but for ordinary purposes of domestic and street-lighting, its cost puts it altogether aside, as too many will practically discover when all the calls upon their shares have been paid up, and the joint-stock "operators" have retired from the field.

In further demonstration of the real age of this supposed infant I will quote a few more historical facts.

More than thirty years ago three of the largest streets of St. Petersburg—the Newski Prospect, the Erbson Strasse, and the Wosneseuski Prospect—were lighted by one lamp placed on the tower of the Admiralty Buildings. In 1854 the works for the construction of the Napoleon Docks at Rouen were illuminated with the electric light, and 800 men worked there during the night as in daylight. Wagner estimated the cost at three farthings per man for three or four hours, or about 17s. per hour altogether. During the last quarter of a century electric lights have been used in light-houses on our own and the French coast, and continue in use, the old arrangements still existing in spite of the prospectuses of the companies that are now angling so successfully for investing victims.

The sober, unvarnished fact is, that electric lighting has made far less progress during the last thirty or forty years than any other mode of lighting now in practical existence. Gas-lighting, as already stated, has far outstripped it in the primary matter of economy of production. Rush lights and tallow dips have been superseded by paraffin candles, and snuffers and snuffer-trays are becoming objects of interest to antiquarian collectors. The modern paraffin candles now sold retail at 6d. per pound are superior to the wax and spermaceti candles that were used thirty years ago, and cost 2s. 6d. to 3s. 6d. per pound.

Middle-aged men remember the rushlights, the tallow dips, the mould candles, and the sperm oil lamps, then the "solar" lamps, then the colza oil lamps, then the "camphine" lamps, the Carcel lamps and the Moderator lamps, all of which are now practically superseded by the single, the duplex, and the triplex mineral oil lamps.

The electric lamp has alone stood still since 1846. Starr tried, and I witnessed his trials of the arc principle, with a score of devices for remedying the flickering, and he did remedy it more effectually than it is now remedied on the Thames Embankment; but he wisely abandoned the arc principle altogether. He did this because, as he explained, the arc light is simply a result of the incandescence of particles of carbon transferred from one pencil to the other, and therefore it would be better to have a solid incandescent stick or filament heated in vacuo, or in carbonic acid or nitrogen. The specification was sealed Nov. 24, 1845. A drawing of the apparatus and a description may be found in the *Mechanic's Magazine* for April 25, 1846, and a letter from myself discussing previous claims for the idea of an incandescent electric light in the same magazine, May 9, 1846.

The order of Starr's progress was curiously like that of Edison, who, throwing overboard the arc light, made his first step with incandescent solids by using a platinum wire and a strip of platinum foil, then an alloy of platinum and iridium. This *novelty* was loudly cried up in the newspapers three or four years ago, but it collapsed. Then came the burnt cardboard, which was but a repetition of another abandoned step of Starr's progress. This effort of "The Wizard of Menlo Park" was so well puffed, that the shares of the company ran up from 30 dollars to 3,500 dollars each, and of course collapsed in the usual manner.

The cardboard incantation of the Wizard being exhausted, another followed—viz., the bamboo—which, as above explained, had also been tried thirty-five years before by Starr; but, in these days of improved commercial enterprise, it has "floated" its companies on both sides of the Atlantic. When it has done its work, we shall probably hear of a further improvement, another great inspiration,—viz., the re-invention of Starr's final gas-coke carbon stick, which is incomparably superior to any of the incandescent devices at present flaunted in the joint-stock market.

Edison will not be able to patent this in America, seeing that he was refused a patent for the platino-iridum idea on the ground of Starr's previous inventions patented by King; but in this country anybody may repatent any invention, however old, and, therefore, when the now popular bits of thread are burnt out, more companies may be built upon the harder, and far more durable gas carbon.

I have already heard of patents for a slight modification of this, which is formed not by burning away the hydrogen compounds from solid vegetable matter, such as wood, coal, card, bamboo, &c., but by *precipitating* carbon from a gaseous compound of hydrogen and carbon. In the gas retorts this is effected by the hydro-carbon gas coming in contact with the red-hot walls of the retort. In the forthcoming improvements on the incandescent electric light it will be done by filling the electric lamp glass with hydro-carbon vapour, and then precipitating its carbon on the thread of carbon rendered incandescent by the current.

Our old experience of 1845-6 proved that this will be a real step in advance, as the carbon thus precipated is so much more durable than any of the forms at present in use.

The above was written about three months ago, and I have held it back hoping that the electromania would have died a natural death ere this, but it has now attained such a magnitude, and some of the prospectuses of new companies and extensions are so atrocious, that to remain silent when one has anything to say, and an opportunity of saying it, is almost equivalent to passive co-operation in the conspiracies.

One more appeal to the common sense of intending investors in these companies. Granting, as we all fairly may, that the electric light is admirably suited for lighthouses, for theatres, for fêtes, for such works as those of the Napoleon Docks, for tunnel-excavators, for the British Museum Reading-room, and other special purposes where cost is not an object, do we require companies with hundreds of thousands of capital to light these places? Do we require any companies at all?

The nature of the practical requirements for electric lighting prove that we do not. All that is needed is a steam-engine, a "dynamo" machine, the lamps, and connecting wires. These can be supplied by private firms, and can be worked on the premises far more economically than from a distance by any great central machine distributing its power to various places. Such distribution demands expensive arrangements of conducting wires, and is accompanied with an amount of loss proportionate to the distance of transfer and the number of subdivisions.

At the Polytechnic we had an engine that pumped the water, worked the fountains and models, and, whenever we required the electric light or worked the electric railway, we simply connected with it the dynamo (a little machine by the side of the engine) and the wires for the light, &c., by means of their proper binding screws. The like may be done on board of steam-packets, in factories, mines, &c., or wherever steam-engines are in use. Those who believe that electricity is to make such progress that it shall supply the light and power of the future should be sufficiently logical to perceive that this progress must supersede all existing inventions, and therefore that the four millions that have been recently paid for the shares and the patent rights, and for the promotion of existing companies has been all thrown away. Ninety-nine per cent. of the patents that have recently been specified at the rate of ten to twenty per week are worthless repetitions of old inventions or delusions altogether.

Luxurious people who choose to pay for lighting their drawing-rooms by electricity may easily do so by means of a little gas-engine and dynamo, worked in the back kitchen or butler's pantry. They have no more need to apply to a company with a capital of £800,000 for such a purpose than has a hairdresser to do so for supplying the motive power to his rotatory hair-brushing machine.

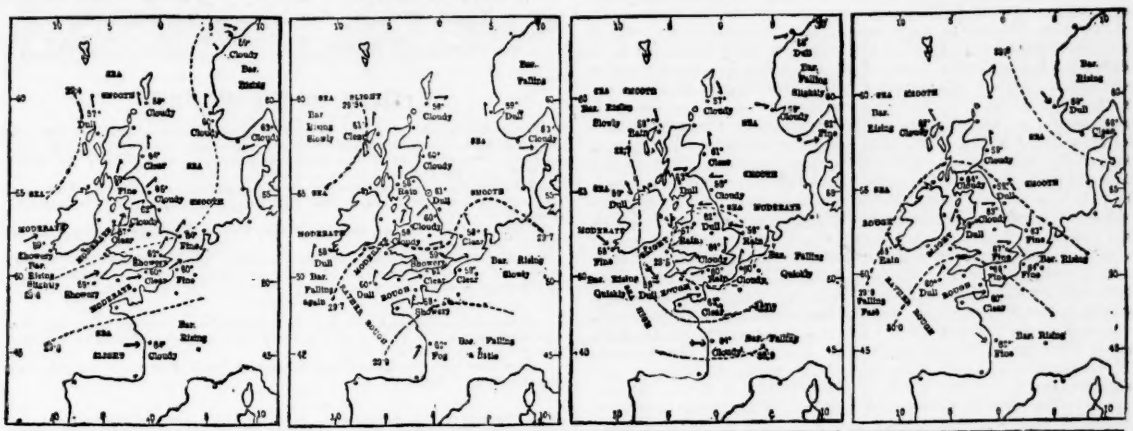
FRENCH EXCAVATIONS IN ASSYRIA.

SOME most interesting particulars of the exploration of M. de Sarzec in Mesopotamia, which were recently mentioned in KNOWLEDGE, are to be found in a letter from the discoverer himself, read before the Paris Academy by M. Heuzy, and a commencement at deciphering the very ancient texts which are engraved on many of the antiquities has been made by Dr. Julius Oppert.

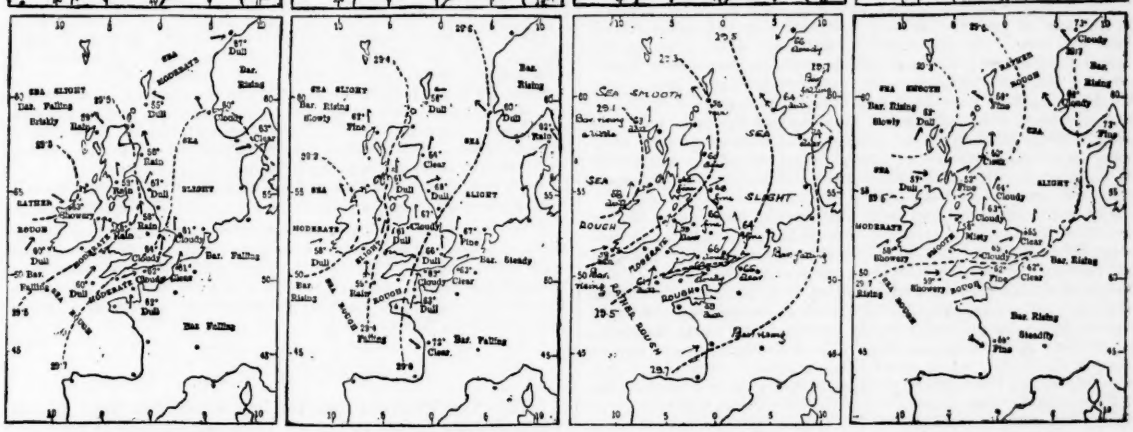
The site which has proved so exceptionally rich in archæologica remains is situated on the left bank of the Shatt-el Hai, a large

WEATHER CHARTS FOR WEEK ENDING SUNDAY, JULY 16.

SUNDAY, 9TH. MONDAY, 10TH. TUESDAY, 11TH. WEDNESDAY, 12TH.



THURSDAY, 13TH. FRIDAY, 14TH. SATURDAY, 15TH. SUNDAY, 16TH.



In the above charts the dotted lines are "isobars," or lines of equal barometrical pressure, the values which they indicate being given in figures at the end, thus—30·4. The shade temperature is given in figures for several places on the coast, and the weather is recorded in words. The arrows fly with the wind, the force of which is shown by the number of barbs and feathers, thus:— ⟶, light; ⟶, fresh or strong; ⟶, a gale; ⟶, a violent gale; ⊙ signifies calm. The state of the sea is noted in capital letters. The * denotes the various stations. The hour for which each chart is drawn is 6 p.m.

canal excavated in pre-historic times to unite the two grand waterways—Euphrates and Tigris. The name Tello is given to the spot by the Arabs, because of the number of Tells, or artificial mounds, which cover the buried city of Sirtella (or Zirgulla). These Tells, which are very numerous, are scattered over a space of six or seven kilomètres, the principal one being at the north-east part of the group. The largest mound was occupied by the ruins of a large edifice in the form of an elongated parallelogram, called by M. de Sarzec a temple, but which may have been a palace, or both. The building was elevated on a massive substructure of crude bricks rising to a height of fifteen mètres above the uniform level of the desert, and having the angles directed to the cardinal points of the compass. During the last two years, M. de Sarzec's researches have been chiefly confined to disinterring the edifice concealed in this greater mound, and it was in it that were preserved the most valuable relics that have been recovered. Almost immediately after the workmen commenced cutting a gallery into the hill, they came upon the exterior walls, which were constructed of burnt bricks cemented with bitumen. All the bricks which have been examined bear the name of Gudea.* In order to more carefully preserve, and arrive at a true comprehension of the architecture of the building, the walls were first laid bare all round, and then an entrance effected by digging away the *débris* from some of the doors and windows. This naturally was a tedious and costly method, but both time and expense were amply repaid by the results.

In the largest hall or court, which proved to be the central one of the block, were found nine statues of diorite, also a sculptured head, nearly life-size. In one of the passages leading from this to another chamber they came upon portions of a statue with the bust covered with inscriptions, and a small statue of peculiarly short proportions, and carved out of a singularly green-coloured stone. Almost every part of the building produced something, but the great inner court proved most prolific, containing, besides the nine statues mentioned, many fragments of inscribed vases and statuettes, an exquisite small head of beautiful execution, and another nearly life-size, with curled beard. In this, as in many of the passages and rooms, numerous seals, cylinders, and other objects, were collected, and at the foot of the outer wall, on the north-east face, a mutilated statue. M. de Sarzec does not tell us whether he broke open the thick outer walls at the corners in search of record cylinders, a process which, however, after the discovery of the splendid perfect decagonal cylinder of Assurbanipal by Mr. Rassam, embodied in the very heart of a corner mass of masonry, seems to be necessary in Babylonian explorations.

* M. de Sarzec says "bear the 'cartouche' of Gudea," but does not give any copy. It would be interesting to know if the royal name is enclosed in an oval, or cartouche, as in Egyptian hieroglyphs.

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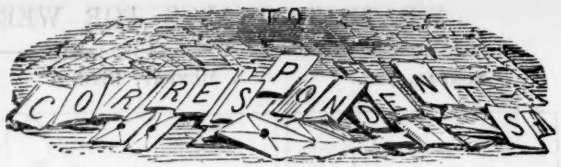
In addition to the larger mound, M. de Sarzec excavated in all the Tells of minor dimensions, finding beneath them in every case masonry built up of crude bricks, each doubtless at one time serving to support an edifice now destroyed. As long back as four years ago one of these hillocks produced two perfectly preserved terra-cotta tablets covered with inscriptions. Beneath two of the mounds two cavities, like tanks, were found, lined throughout with dried bricks plastered on the interior and cemented with bitumen; near these lay a hemispherical block of white marble, bearing a circular inscription. At one place was exposed two fragments of a bas-relief, engraved with very archaic cuneiform text, and carved with battle-scenes representing warriors prostrate on the ground, and vultures flying above them with human remains in their talons. One of the most curious discoveries, however, took place on the plains, close to the mounds, where, about thirty centimètres beneath the primitive soil, lay four cubes of solid masonry, built up of large bricks and bitumen. In the centre of each was a cavity filled with fine yellow sand, and in each cavity was a bronze statuette, either of a man kneeling or a female standing. At the base of each statue, embedded in the bitumen lining of the recess, were two stone tablets, one white and one black, the latter nearly always bearing an inscription which was duplicated on the statuette itself.

In one respect, every "Tell" told a similar story, for all bore ample evidence of destruction by fire, and many of the valuable objects forming the collection, such as fragments of alabaster and marble vases, were found calcined and embedded in ashes. In one, among other *débris*, were found portions of a marble statuette, numerous clay contract tablets and a life-size figure of a bull's horn, made of plates of copper, moulded over a wooden model which was completely carbonised by the heat. Here, also, lay the curious head wearing a turban which explains the form of head-dress so invariably delineated in such minute size on the oldest Babylonian seals. Some of the structures, as described by M. de Sarzec, exhibit most remarkable architectural features, but it is difficult to understand their arrangement without plans; still, enough may be ascertained to provide, together with an account of Dr. Oppert's translation of some of the inscriptions, a further paper which will prove of interest.

However desirous one may be to elaborate a description of this ancient civilisation, and correctly classify the antiquities now collected in the Salle devoted to M. de Sarzec's relics from Tello, at the Louvre, and appoint them their position in the history of the culture of mankind, it must be admitted that the time for doing either has not yet arrived. The difficulty of deciphering the texts is great, and even when they can be rendered into words, the meaning of many of them is uncertain. For instance, it is not known whether the Gudea, whose name is upon nearly every object disinterred, was an independent prince or sort of viceroy over this part of Mesopotamia. The signification of the title Patesi which he gives himself not being exactly known, Dr. Oppert points out that some words in the texts require to be read vertically, and altogether much is at present uncertain.

A writer in a contemporary recently asserts, to his own satisfaction, the decidedly Ugrio Finnic or Turanian type of features indicated by the heads of statues, whilst M. Heuzy tells us how surprisingly Semitic he finds them. Fortunately, this uncertainty will soon be dissipated; the inscriptions are, when correctly understood, ample to render up the wished-for information, and certainly their secrets will slowly but surely be wrested from them. To such veterans as Rawlinson and Oppert, who, unaided by a single analogy, have conquered the difficulties of the three languages of the Behistun and other inscriptions, though the very sounds of the signs were unknown, these texts will prove but slight obstacles, and when mastered may afford a stepping-stone to approach the conquest of still stranger scripts that may yet be disinterred from the teeming soil of Babylonia.

THE EDISON AND SWAN LAMPS.—The solicitors of the Edison Electric Light Company write stating "That the board of that company are advised that the lamp known as the Swan incandescent lamp is an infringement of the Edison patents." The solicitors of the Swan Company, rejoining, state that "they are advised that the Swan incandescent lamp is not an infringement of the Edison or any other patent. The Swan lamp has been before the public unchallenged for a considerable time, 1,200 of the lamps having been nightly in use for several months past at the Savoy Theatre alone." A contemporary pertinently asks:—"Is this the beginning of a sham battle preparatory to a combination of the two companies?" It is to be hoped not, if only for the sake of the public. We believe the Edison faction claim the original discovery of the process for expelling from the filament the occluded gases, but it is our impression that Mr. Swan can claim priority.



Letters to the Editor.

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**** All letters to the Editor will be Numbered. For convenience of reference, correspondents, when referring to any letter, will oblige by mentioning its number and the page on which it appears.*

"In knowledge, that man only is to be contemned and despised who is not in a state of transition. . . . . Nor is there anything more adverse to accuracy than fixity of opinion."—*Faraday.*

"Show me a man who makes no mistakes, and I will show you a man who has done nothing."—*Liebig.*

THOUGHT READING AND THOUGHT RULING.

[475]—In the "Answers to Correspondents," you state, and rightly, that the truth of the facts asserted in my account of Caseneuve's feats depends solely on my veracity and the trustworthiness of my friend. With regard to the trustworthiness of my friend, let me say that we were travelling together, and that it was the day after our arrival at Athens that we attended Caseneuve's entertainment. I am not at liberty to publish my friend's name, but I enclose it for the Editor's information.

With regard to the question of my veracity, I will content myself with signing my name in full. HENRY MILTON.

[I am much obliged to our correspondent for thus adding weight to his evidence, though for my own part I had accepted his account with full confidence. Like Dickens's, it tends to prove more than thought reading—it proves thought ruling. There are few more interesting subjects of scientific inquiry than this influence of mind over mind.—R. A. PROCTOR.]

RATIONAL DRESS.

[476]—The kind and encouraging notice you gave of the Rational Dress Society and of my pamphlet, leads me to hope that you would allow me to place before your readers a sketch of the plan of the "Anti-Fashionable Magazine" I am anxious to start. In the first place, a periodical is wanted to act as a corrective against those pernicious fashion papers which, month by month, incite our women to self-torture and slow suicide. Secondly, I wish to show that fashion in dress is but part of a larger question, and that is, the sinister influence which fashion exercises over the whole of our home and social life.

We women have been so preached-to about the "woman's sphere," that verily we have become sick of the subject; but now I am beginning to see what the sphere really is, and that it is a beautiful one and a worthy one. It means the world of rest and of pleasure, the blossoming of life, the outward expression of the highest cultivation of the age. Now, this sphere, not having true principles from within to guide it, is ruled by arbitrary dictates from without, called Fashion. To discover these principles, and further to apply them practically to daily life, is a task of the very greatest difficulty. As the difficulties of sociology are to those of the other sciences, so would the difficulties of this science of domestic life be to sociology. If we try to reform this small portion of it—dress—we have to consult the laws of health and the laws of art—or, as I prefer to say, the laws of beauty—and at the same time the comfort, convenience, and several wants of the various wearers.

I have been accused of being apparently totally wanting in artistic feeling, "a person singularly devoid of art sense," says the *Queen*. On the contrary, I worship beauty; it is a perpetual grief to me that all beauty of form is being lost to us. But Art has hitherto been antagonistic to Nature in dress. It has not considered the needs of the body to be dressed, that it is a moving, working animal to be clothed, not a gracefully posed lay figure to be "draped" for exhibition in a picture or a statue. And, as I have before said, the taste of the day is too vicious and degraded for any true ideas of beauty or grace to be evolved from it. We must be

content to wait. This is our punishment for our sins against nature and true art. But it surely is with this as with everything else in life. "Seek ye *first* the kingdom of God (or the good) and His Righteousness (or the right), and all these things (the outward beauty) shall be added unto you." It *must* be so, for beauty is inherent in the good and the true. This is but an imperfect sketch of what is but an imperfect idea in my own mind. My ability to work it out is but small, but I wish to make it the work of my life, and if I succeed even in the smallest degree, I shall think it no unworthy work.

I shall be only too glad of any advice as to the best means of practically carrying out my plan.

34, Cornwall-road, Bayswater. E. M. KING.

METEOR, &c.

[477]—Many thanks to you for inserting my letter on "Meteor" in KNOWLEDGE. I am pleased that you considered it sufficiently interesting.

I saw in *Nature*, of June 8, page 124, a letter on the same object from the Stoneyhurst Observatory, which is about twenty-two and a-half miles from here in a N.N.E. direction. The meteor was seen by several persons about there, but in a very different direction to where I saw it. It first appeared to them near Arcturus, and passed between δ and ϵ Ursa Majoris, bursting under α Ursæ. This path differs so greatly from mine that, taking into account the comparative nearness of the two places of observation, I think it indicates pretty clearly that the meteor must have been very near the earth. Indeed, it appeared very near to me; literally speaking, it did not seem to be many yards from me. Unfortunately, I cannot give a more exact description of its path than the one given in my previous letter, as it passed so quickly and was such a startling sight, that I had not time to note its exact position. EXCELSIOR.

LAW OF PROBABILITIES.

[478]—Playing Loo with two friends many years ago, one card—the Nine of Diamonds—turned up trump such a vast number of times that we were quite excited about it, and subjected the card to a most searching examination, but could detect no difference between it and any of the others. We then resumed play, resolving to count, and after that the same card turned up trump thirty-nine times.* What does the law of probabilities say to that? HALLYARDS.

* In how many trials?—ED.

BREAK FOR A TWO-WHEEL VEHICLE.

[479]—Hinge a bar at each side at any point under the trap, and *before* the wheel. Let these bars be two or three inches longer than the height of the trap, and kept *back* and off the ground by a spring, and let there be a foot or more of rod above the hinge that may be acted upon by the driver pulling it towards him by a cord, screw, or any other arrangement, and this will bring the lower end more or less firmly upon the ground, and check the vehicle, and lift the weight off the horse's back. This is the principle of the Carter break that is applied to bicycles, and I think is patented; but information on this point can be got from Singer & Co., "Challenge" Bicycle Works, Coventry. G. S.

A MODERN SURGEON'S TOOLS.

[480]—The astute, sympathetic, and skilful Mr. Smaller will, I hope, pardon Mr. Smallest relating as briefly as possible the method adopted in a modern shop when an operation similar to that so touchingly described by him is performed.

A trochar and canula of a new form, but possessing the same much-despised point, previously well sharpened and polished to perfection with Tripoli and wash-leather, is placed in a tepid solution of carbolic acid beside the patient's couch.

The place selected for puncture is painted with a strong solution of the same drug, which renders it completely insensitive. The instrument removed from the bath is coated with a small quantity of a beautiful antiseptic ointment called vaseline.

The operator with a rapid, skilful stroke, sends it through the insensitive tissues, and the pent-up fluid glides noiselessly from the part through an indiarubber tube to the vessel intended for its reception.

The form of the point as at present made is necessary, the bluntness Mr. Smaller desires removed, enabling it to push aside important vessels lying in its course, thus preventing their severance and injury. A. COWLEY MALLEY, B.A., M.B., B.CH.

THE HIGHLAND CELT.

[481]—It seems to me that the word "brown," as used by "Charles Stewart," really means dark, and does not necessarily imply "light, fair, or sandy," but the contrary; in the word *gaidhill-dhoneur*, for instance, is not the suffix a derivative of "dhu," meaning black? while the southern equivalent, called "dun," is certainly dark. Speaking ethnologically, I should call brown hair the result of a mixture between the aboriginal dark Britons and the fairer Teutons or Gauls; and the reference to Tacitus is unfortunate, because that author uses the word "rutilæ," meaning unmitigated "carrots"—not brown.

Then, again, Breadalbane can hardly be called the true highlands of to-day; that district lies south of the Grampians, and the real Caledonians—the wild Highlanders—are north of that range. Perthshire was overrun and partly civilised by the Romans long ago; since which, a variety of Teutonic tribes have poured in, and but little Gaelic is spoken in the country parishes; perhaps it would prove more germane to the matter to ask Mr. Stewart's friendly schoolmaster as to blue or grey eyes, and as to red hair; for that gentleman does not appear to see that, even in the days of Agricola, the Caledonii are described as a mixed race, which fact leaves us as far as ever from deciding what was the original complexion of the primitive Highland Celt. A. H.

FIFTEEN SCHOOL-GIRLS,

Viz., *A*Aa, *B*Bb, *C*Cc, *D*Dd, *E*Ee.

[482]—First day the A's, B's, &c., to walk together thus:—

1st.	
*A*Aa	To make the problem more definite, add the following
*B*Bb	conditions, viz., that the A's on the other six days are to
*C*Cc	walk in the first three rows; *BCDE* in the first row, or
*D*Dd	first in the fourth and fifth rows; BCDE in the second
*E*Ee	row, or second in the fourth and fifth rows; bcde in the third row, or third in the fourth and fifth rows. The

following is obtained:—

2nd.	3rd.	4th.	5th.	6th.	7th.
ABC	*ADE*	A*BD*	A*EC*	a*BE*	a*CD*
ABC	AED	aDB	aCE	*A*EB	*A*DC
ade	abc	*A*ec	*A*bd	Acd	Abc
*D*Eb	*B*Cd	*E*Cb	*B*De	*C*Db	*B*Ec
*E*Dc	*C*Be	*C*Ed	*D*Bc	*D*Ce	*E*Bd

It will also be observed that the girls in the last two rows on the second day walk with the A's on the third, and those with the A's on the second walk in the last two rows on the third day, and so on the fourth and fifth, also on sixth and seventh. C. E.

COLD SNAPS.

[483]—With reference to cold snaps, do you know what the weather has been during the spring and early summer at Madeira?

I spent a winter there a year or two ago, and found February decidedly the finest month. The beginning of May (I left about the 12th) was absolutely cool, and the hills round Funchal were covered with snow, which was represented to me as a most unusual, if not an unprecedented, occurrence for the time of year.

In Teneriffe also, about the middle of April, the north-east trade wind was blowing, and out of the sun the weather was cool, not to say cold, particularly in the morning and evening.

I attributed, in my own mind, the freshness of Madeira in May, and the character of the Teneriffe wind in April, to ice in the Atlantic. It would, therefore, be interesting to learn whether this year, when we know that there has been an unusual quantity of ice about, a similar retardation of warm weather has taken place in these two semi-tropical islands.—Yours truly, G. H. O.

HAIR TURNING WHITE.

[484]—Perhaps the following may interest some readers of KNOWLEDGE. Less than a year ago I had a sudden and very heavy disappointment. My mind was so disturbed that I could not sleep at all during the night. Towards morning it occurred to me that my hair had changed colour. But I felt too sick to care to examine it. Either that morning or the next, I noticed a small white patch of hair just over the centre of my forehead, and some days after the back of my head was noticed to be covered with little groups of white hairs. I tried by change of air and scenery to regain my spirits, thinking my hair would return to its ordinary colour, black; but since then it has become slightly whiter. W. E. F.

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Answers to Correspondents.

**** *All communications for the Editor requiring early attention should reach the Office on or before the Saturday preceding the current issue of* KNOWLEDGE, *the increasing circulation of which compels us to go to press early in the week.*

HINTS TO CORRESPONDENTS.—1. *No questions asking for scientific information can be answered through the post.* 2. *Letters sent to the Editor for correspondents cannot be forwarded, nor can the names or addresses of correspondents be given in answer to private inquiries.* 3. *Correspondents should write on one side only of the paper, and put drawings on a separate leaf.* 4. *Each letter should have a title, and in replying to a letter, reference should be made to its number, the page on which it appears, and its title.*

M. B. ALDER. (1) Ah! if surmise were but certainty. (2) In half the 25,900 years the earth's axis has swayed through its precessional range with respect to the star-sphere; but its inclination to the plane of the ecliptic is not much altered, and, such change as there is, is periodic. (3) I do not know whether the gentleman whose letter to your father you forward me is now alive.—J. A. D. If in an urn there are as many alphabets as there are letters in the sentence, "Up guards and at them" (*i.e.*, 17 alphabets, or 442 letters); the chance that these words will be drawn in their exact order will obviously be

$$17^{17}\left(\frac{2\,.\,1\,.\,1\,.\,1\,.\,3\,.\,1\,.\,2\,.\,1\,.\,2\,.\,1\,.\,1\,.\,1\,.\,2\,.\,1\,.\,1\,.\,1\,.\,1}{442\,.\,441\,.\,440\,.\,.\,.\,.\,.\,.\,.\,.\,.\,.\,.\,427\,.\,426}\right)$$

I would not deprive you of the pleasure of working out this little sum for yourself.—QUICKSILVER. If the sides of a right-angled triangle are in geometrical progression, and the area 579, you get, if you put the sides equal to x, xy, and xy^2, the equations—

$$x^2 + x^2y^2 = x^2y^4 \text{ or } 1 + y^2 = y^4$$

and

$$x^2y = 579$$

whence y and x readily obtained.—J. HAMILTON. That comet was seen in England. See subject Comets in my article on Astronomy in the "Encyclopædia Britannica." It is a very celebrated comet. —W. COFFEY. The work, if sent to us, shall receive what you ask for—fullest consideration.—JARDINE PERKINS. Saying the moon has an apparent diameter of about a foot would imply that the moon appeared to be about thirty-six yards away. If this, regarded as a scientific statement, is not nonsense, I do not know what is. Have you never seen the moon, as she rises above a distant hill, appear larger than a house on that hill, though you knew the house to be a good deal more than a foot both in height and breadth? Apparent diameters and distances between objects are not measurable in feet or yards, but by the angles they subtend. On the other point you are right. Yes, my reference to indicating distance in hogsheads and kilderkins *was*, as you presume, a joke; yet the absurdity is no greater than in indicating the apparent diameter of the sun in inches. — C. E. MUNROE. Thanks for your interesting letter. — W. B. May 12 is Old May-day in the sense in which I wrote—that is, May 12 corresponds to the day of year which before the style was altered was called May 1. But if the style had not been changed in the eighteenth century the year 1800 would have been a leap-year, and May-day would have fallen on what is now called May 13. In that sense May 13 is Old May-day. After the year 1900 May 14 will be Old May-day.—E. BROWN. No such sketch-maps are sold to my knowledge. In my "Half-Hours with the Telescope" data are mentioned for their construction.—E. R. COWLEY. Most of those points will be treated of in the series of papers on "How to get Strong." Author cannot answer individual querists.—CLAUDIUS. No medical man would give an opinion without seeing you. Several non-medical men would, I daresay, tell you "all about it," if your letter appeared. Seriously, you should not ask for opinions which could not but be utterly untrustworthy.—W. P. wishes to know where Turkish tobacco, mentioned by "Constant Reader," page 79, vol. ii., can be obtained. He mentions also that about one mile from Swindon Junction, in an extension line to Marlborough, the ballast of the line is full of casts of fossil shells—a rich field for the geologist.—J. H. T. wishes to learn what formula is used for logarithms with the aid of the table in De Morgan's edition of "Shrön's Logarithms."—G. BRUNTON. (1) Your solution of the top problem is quite inadmissible. How can it be said that gravity has not time to act? When a bullet is travelling at its swiftest, gravity finds time to act with full effect. The difference between the pressure of the air on the under and upper surface of the top, again, whether sufficient or not to produce any effect, acts upwards precisely as the top's weight acts downwards, though with much less energy. Therefore, if gravity has not time to cause the top to fall by acting on the top's weight, neither can it have time to cause the top to rise, by producing an upward air-pressure. (2) With regard to the pyramid, the question really is *how* you could set up your perfectly vertical line 50 ft. high, and *how* from your horizontal line 100 ft. south of it you would bring this upright into line with Alpha Draconis, &c. What you say you would do, an astronomer or a practical surveyor would show you to be absolutely impossible, with anything like the necessary degree of accuracy. On the contrary, the orientation by slant subterranean passages could be made to all intents and purposes perfect. The passages would, at first, be bored with only rough approximation to the desired direction; but the deeper they were carried the more perfect would be their working and slant, because Alpha Draconis could be observed along them at every sub-polar passage. Whensoever they had been carried down deep enough, a vertical boring could be carried down to the subterranean chamber into which the slant passage opens, a plumb-line could be let fall down this vertical boring: it might be a yard, or a foot, or more or less (according to the success of this first rough attempt to get a vertical mid line due south of the entrance) from the observed direction of the visual line along the middle of the descending passage to Alpha Draconis. Whatever correction had thus to be made, would, of course, be made east or west from the top of the vertical boring, giving a point due south of the centre of the entrance-hole of descending passage. The orientation thus obtained—practically perfect before the first layer of stones was placed—would be checked and improved (to something like theoretical perfection) as layer after layer was added. Permit me to say that no astronomer would regard your plan as capable of any scientific accuracy, while every astronomer sees the plan of a long slant passage directed to the pole star to be the only perfect way, though involving much labour and expense. As a trifling detail, it may be added that the passage is *there* with the proper northing and slope. You may prefer to believe that though the passage is thus carefully directed due north, and with an inclination bringing it to bear on the pole star of the day, it was really only meant for the sliding down of great stones; so also if you were shown how perfectly the stand of an equatorial telescope is suited to keep the telescope directed upon a star, you might answer that, in your opinion, the instrument was intended for a pump: but you must not expect every one to agree with you.—LORESMITH.—How do you make £6,960 in third year provide for fourteen allotments of £500 each, with £440 over?—G. E. A. I do not find anything in Mr. Clodd's account of deposit of stalagmite over inscription to show that the deposit only takes place round the letters and not over them as well.—J. M. N. Gray's Anatomy, profusely illustrated.—J. EVANS. With thanks.—E. CARUS WILSON. The subject has been fully discussed in early numbers of KNOWLEDGE. The ice yachts only travel faster than the wind when the wind is more or less abeam. It can be shown that when a yacht is running with a velocity equal to the wind's (abeam) there remains effective driving action. Do not know whether tigers purr like cats.—H. D. No, the forward motion does not in any affect the action of gravity. It is a law of motion that each force acting on a body produces its full effect.—TOM T. Thanks. Excuse delay; your letter arrived when I was far from well. There are delicate but characteristic distinctions between the business type of face and the literary or scientific type. They have not, so far as I know, been classified, as Le Brun classified the effects of different emotions on the features (to refer only to artistic classification). They are in no way connected with "the science of phrenology" (there is no such *science*).—W. B. WICKEN. Thanks for your very kind and encouraging communication.—W. H. G. I fear it would be difficult to obtain any remunerative situation of the kind described.—E. N. *Is* it easier to swim in deep than in shallow water? It would be well to be sure of the fact before seeking to explain it. I have swum for more than an hour at a time in deep water, and for long spells in shallow water, without noting any difference of the kind.—ERIN-GO-BRAGH. There are several methods of vulcanising. One is to immerse thin sheets of rubber in melted sulphur, and then roll them together. This is the most crude and the earliest. Parkes's is better. The rubber is immersed in 40 parts of bisulphide of carbon and 1 part of chloride of sulphur, then heated gently and carefully till the bisulphide is volatilised. The rubber is next boiled in a weak solution of caustic potash (500 grammes to 10 litres), and then washed to remove the alkali. I might add many other recipes, by the aid of which, as with the above, ERIN-GO-BRAGH will equally fail to obtain a moderately good specimen until he has spoiled a hundred or less of trial samples, and thereby learned the business.

ELECTRICAL.

A. H. H. The Maynooth battery has about three-fourths the electro-motive force of a Bunsen, but it is very uncertain, irregular, expensive, and altogether an unpractical type. Your other query involves several nice points, but if Mr. Editor can find room, I will deal with it next week.—S. E. KELP. Your castings, I am informed, were duly despatched on the 28th ult. If not yet to hand, write again to the founders.—STEADY SUBSCRIBER. See answer to "CONSTANT READER" a fortnight since.

Science and Art Gossip.

WE regret to announce the premature death, at the age of 32, of the celebrated electrician, M. Antoine Breguet, of Paris.

MESSRS. FELTEN AND GUILLEAUME give the following figures as the relative resistances of equal lengths of various metals at the same temperature and of the same section :—Copper, 1·5; phosphor bronze, 6·5; Swedish iron, galvanised, 8·7; Bessemer Swedish steel, galvanised, 9; German charcoal iron, galvanised, 10·3; Siemens-Martin iron, galvanised, 10·8; coke-iron, galvanised, 12; patent cast steel, 13·7 to 15·2.

AN exhibition of life-saving apparatus of all kinds has been opened in the Alexandra Palace. The exhibition is divided into the following six classes or sections :—(1) Railway safety appliances, including continuous brakes, signalling, and point-locking apparatus, switches, &c., this being the leading feature; (2) means for extinguishing fires, and the rescue of people therefrom; (3) mining safety appliances; (4) apparatus for all marine and inland water emergencies; (5) surgical and sanitary; and (6) engineering and miscellaneous safety appliances.

INSULITE.—We have received a letter from Dr. Fleming, the inventor of this material, complaining of the criticism we made on it a fortnight since. He sent us fresh specimens, which are certainly an improvement on those we saw a few weeks since, but it is still very far from being, in our opinion, of any practical utility. Exception was taken to our assertion that the material would not hold small screws, an assertion which we cannot withdraw, inasmuch as, although the screw bites well at first, it can never be driven fairly home. We believe that, as Dr. Fleming says, a supply of insulators has been furnished to the Post-office, and they are now undergoing a trial. There are other points we should like to refer to, but we forbear, hoping that Dr. Fleming will be able to overcome such practical difficulties.

INVESTIGATIONS made in Germany concerning the comparative vitality of children under various methods of feeding exhibit some peculiar results. Thus, of 100 children nursed by their mothers, only 18·2 died during the first year; of those nursed by wet nurses, 29·33 died; of those artificially fed, 60 died; and of those brought up in institutions, 80 died to the 100. Again, taking 1,000 well-to-do persons and 1,000 poor persons, there remained of the prosperous, after five years, 943, while of the poor only 655 remained alive; after fifty years, there remained of the prosperous 557, and only 283 of the poor; at seventy years of age there remained of the prosperous 235, and but 65 of the poor. The total average length of life among the well-off class was found to be fifty years, as against thirty-two among the poor.

MESSRS. HEROLD & GAWALOWSKI, of Brunn, make as follows a strong, artificial parchment, impermeable by water, and capable of serving for the diaphragm in osmotic operations on solutions of impure sugar, &c. :—The woollen or cotton tissues are freed, by washing, from the foreign substances, such as gum, starch, &c., which may cover them. They are then placed in a bath slightly charged with paper pulp; and to make this pulp penetrate more deeply, they are passed between two rollers, which slightly compress them. The principal operation consists in steeping the product for a few seconds in a bath of concentrated sulphuric acid, after which it undergoes a series of washings in water and ammoniacal liquor, until it has lost all trace of acid or base. It is then compressed between two steel rollers, dried between two others, covered with felt, and finally calendered, when the sheets are fit for use.

OBSERVATIONS made by M. Rafford, a member of the Société d'Horticulture at Limoges, show that a castor-oil plant having been placed in a room infested with flies, they disappeared as by enchantment. Wishing to find the cause, he soon found under the castor oil plant a number of dead flies, and a large number of bodies had remained clinging to the under surface of the leaves. It would, therefore, appear that the leaves of the castor-oil plant give out an essential oil or some toxic principle which possesses very strong insecticide qualities. Castor oil plants are in France very much used as ornamental plants in rooms, and they resist very well variations of atmosphere and temperature. As the castor-oil plant is much grown and cultivated in all gardens, the *Journal d'Agriculture* points out that it would be worth while to try decoctions of the leaves to destroy the green flies and other insects which in summer are so destructive to plants and fruit-trees.

THE AMEYA IN JAPAN.—This clever stroller's stock-in-trade consists of a little bench, furnished with a lamp, some plastic sugar, red and blue pigments, a few twigs of split bamboo, and a pair of scissors. Taking a lump of the sugar in his hands, he makes a funny speech to the parti-coloured little crowd, and ends by asking what it is their pleasure he shall produce. "A dragon," shouts some bold little beauty, while a murmur of approbation arises, and every eye is fixed on the artist. Little by little, the terrible creature grows out of the paste, a collection of unrelated details at first, which a few sudden touches complete as if by magic. Now some one calls for a gourd, another for a tortoise, a third for a man on horseback, and a fourth for a monkey swinging by its tail. It is a contest between the children and the old man, but they cannot nonplus him, try how they will. No matter what they call for, the ameya is equal to the occasion, and within three minutes his dexterous fingers conquer every difficulty which his audience may propound.—Mr. Pidgeon, in "An Engineer's Holiday."

ON the 11th inst., Lieut.-Col. Webber, R.E., the President of the Society of Telegraph Engineers, held a reception at Chatham. About 500 of the members attended, and were conducted in parties of about twenty-five over the various schools, &c., a short lecture on submarine mines having been previously delivered by Major Armstrong, R.E. The closing episodes in a very pleasant day's excursion were the blowing down of a stockade by 25 lb. of gun-cotton, the explosion of a submarine mine containing 100 lb. of gun-cotton in the Medway, and a subterranean mine of 1,000 lb. of gunpowder. As this was the first day of hostilities at Alexandria, especial interest was attached to these experiments, and everyone present left with a very marked impression of the powers of these materials, and of the vast superiority of gun-cotton over powder. The sight of enormous columns of water in the one case, and of earth and rocks in the other may, indeed, be called magnificent. Altogether it was an exceedingly enjoyable day, and the members felt universally grateful to their guests.

NOTORIETY.—The Guiteau case has brought out very strikingly the passion for notoriety, which seems to be fast becoming the disease of the modern world, and seems likely to become one of its great social forces, much as religious fanaticism was in the Middle Ages. It is not until such an event as President Garfield's assassination occurs that we get a realising sense of the burning desire to escape from the ordinary obscurity of their lives by which tens of thousands of persons are consumed, and the lengths they are prepared to go, if need be, in absurdity, to become known or talked about. If they cannot accomplish this by any act of their own, they are only too glad to accomplish it by connecting themselves in some manner, however queer or grotesque, with some notorious person. If they cannot be as much talked about as Guiteau, they are made happy by being able to retail Guiteau's talk. If they cannot have, like him, the fame of being hanged, without the suffering and the shame, they are content to furnish a patent gallows, or make the rope, or suggest a new device in knots, or in any manner whatever be publicly mixed up with an affair about which everybody is talking, and to have the air of knowing something more about it, be it ever so little, than other people. Of course this passion is fostered by the publicity afforded by the newspapers, which, indeed, are to love of notoriety what the sun is to plants. That it will increase is very certain, and that its power as a cause of crime as well as of folly will be recognised more fully as the years go on is, we think, equally certain.—*The Nation.*

IN the July number of the *American Naturalist*, Mr. Ivan Petroff, in a valuable paper on the "Limit of the Innuit Tribes on the Alaska Coast," makes some important observations on the rate at which shell-heaps accumulate. He says :—"The time required for the formation of a so-called layer of 'kitchen refuse' found under the sites of Aleutian or Innuit dwellings I am inclined to think less than indicated by Mr. Dall's calculations. Anybody who has watched a healthy Innuit family in the process of making a meal on the luscious echinus or sea urchin would naturally imagine that in the course of a month they might pile up a great quantity of spinous *débris*. Both hands are kept busy conveying the sea fruit to the capacious mouth; with a skilful combined action of teeth and tongue, the shell is cracked, the rich contents extracted, and the former falls rattling to the ground in a continuous shower of fragments until the meal is concluded. A family of three or four adults, and perhaps an equal number of children, will leave behind them a shell monument of their voracity a foot or eighteen inches in height after a single meal. In localities in Prince William Sound I had an opportunity to examine the camp-sites of sea-otter hunters on the coast contiguous to their hunting-grounds. Here they live almost exclusively upon echinus, clams, and mussels, which are consumed raw in order to avoid building fires and making smoke, and thereby driving the sensitive sea-otter from the vicinity. The heaps of refuse created under such circumstances during a single season were truly astonishing in size. They will surely mislead the ingenious calculator of the antiquities of shell heaps a thousand years hence."

XUM

Our Mathematical Column.

EASY LESSONS IN THE DIFFERENTIAL CALCULUS.

No. IV.

WE are now to consider the differential coefficients of certain familiar expressions, and to lay down rules by which the differential coefficient of any expression can be readily determined.

In the first place, let me note that, for convenience, the quantity whose differential coefficient is to be determined is commonly called either y or u; and the quantity whose variation causes the former to change is commonly expressed by x. I select y for the former and retain x for the latter purpose. Let it be remembered that there is no real necessity for any fixed practice in this matter. In the last lesson, for example, I used in one case s and t instead of y and x, while in the other example I interchanged x and y.

Let me repeat that the differential coefficient of one quantity y with respect to another x, is an expression indicating the rate at which the former *increases* as we increase the latter. I advisedly use the word *increase* as respects y, even though increase of x may cause decrease of y. For in such a case the differential coefficient will come out *negative*, and a negative increase is the true algebraical equivalent of decrease.

And now for the differential coefficients of the simple function.

If $y=a$, or is constant, its differential coefficient with respect to x is of course 0.

Let $y=x^n$, where n is a positive whole number. In this case we will go through the process for finding the differential coefficient. We increase x by Δx and assume that y is thus increased by Δy.* Then

$$\begin{aligned} y + \Delta y &= (x + \Delta x)^n \\ &= x^n + n x^{n-1} \Delta x \\ &\quad + \left\{ \begin{array}{l} \text{a finite number of terms involv-} \\ \text{ing } (\Delta x)^2, (\Delta x)^3, \text{ \&c.} \end{array} \right. \end{aligned}$$

and $y = x^n$

Therefore subtracting

$$\Delta y = n x^{n-1} \Delta x + \text{terms involving higher powers of } \Delta x \text{ than the first.}$$

Hence,

$$\frac{\Delta y}{\Delta x} = n x^{n-1} + \text{terms involving } \Delta x \text{ and its powers.}$$

Now suppose Δx, and therefore Δy, to become indefinitely minute, calling them respectively dx and dy, and we have

$$\begin{aligned} \frac{dy}{dx} &= n x^{n-1} + \left\{ \begin{array}{l} \text{a finite number of indefinitely} \\ \text{minute quantities.} \end{array} \right. \\ &= n x^{n-1}. \end{aligned}$$

The extension of this proof to the cases where n is fractional or negative, or both, would not suit these columns. Let it suffice that for all values of n

$$\text{if } y = x^n \quad \frac{dy}{dx} = n x^{n-1}.$$

But let us remove this result from the region of algebraical expressions for a moment, in order that its significance, and the significance of sequent results, may be fully recognised. Take x to be 10, and n to be 4, then

$$y = 10^4 = 1000.$$

Try now the effect of adding to y some small quantity, say 1-100th, or ·01. Then instead of 10^4, y becomes $(10{\cdot}01)^4$, and if we calculate the value of this, we find it to be

$$10040{\cdot}06004001$$

The effective part of the increment of y is the 40, and the proportion it bears to the increment of x (or 1-100th) is 4000. This is 4 times the cube of 10, or $n x^{n-1}$. And so in any case the reader may care to try: whenever $y=x^n$, a minute increase in the value of x gives to y an increase $n x^{n-1}$ times as great.

The general result enables us to at once express the differential coefficent of all such quantities as $\sqrt{x}$, $\sqrt[3]{x}$, $\frac{1}{x^2}$ and so on. It is only necessary to write these (or conceive them written), in the forms $x^{\frac{1}{2}}$, $x^{\frac{1}{3}}$, x^{-2}, to see that the respective differential coefficients are $\frac{1}{2} x^{-\frac{1}{2}}$, $\frac{1}{3} x^{-\frac{2}{3}}$, and $-2x^{-3}$, which we may write respectively $\frac{1}{2\sqrt{x}}$, $\frac{1}{3\sqrt[3]{x^2}}$, and $-\frac{2}{x^3}$. Any one who has become at all practised in applying the differential calculus, would of course write down these results at once. It is plain, too, from the mode of proof that if $y=ax^n$, where a is constant, $\frac{dy}{dx} = an x^{n-1}$.

The next simple function I shall take is the sine of an angle. And having in view the importance of the reader's obtaining clear views of the nature of a differential coefficient, I shall in this case employ a geometrical way of finding such a coefficient.

Let the angle x be represented by AOB, Fig. 1; then using the arc measure and making the radius unity, we have

x = arc AB,

and sin. x = BF, where BF is perpendicular to OA,

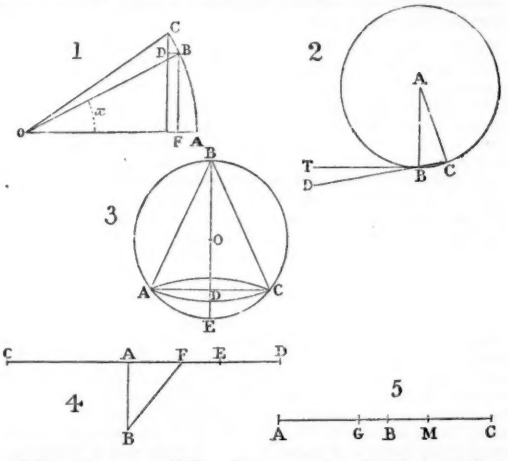
= y suppose.

Now let angle AOB receive the small increment BOC, and call the arc BC, Δx; then, completing the figure, the corresponding increment of the sine is CD. Hence

$$\frac{\Delta y}{\Delta x} = \frac{\text{CD}}{\text{CB}}$$

Now it is clear that as C is brought nearer and nearer to B, the figure BCD approaches more and more nearly to the figure of a triangle similar to BOF; and therefore, the ratio $\frac{\text{CD}}{\text{CB}}$ approaches more and more nearly to the ratio $\frac{\text{OF}}{\text{OB}}$. Hence when C so moving is *just coming upon* B (in which state of things call BC dx, and CD dy) we have

$$\frac{dy}{dx} = \frac{\text{OF}}{\text{OB}} = \cos x.*$$



* It is most important to remember that Δx is a single quantity, not Δ multiplied by x, but the increment of x. In the old notation of fluxions, a simple expression was used. But in advanced applications of the differential calculus, the notation of fluxions fails totally, and the dx's and dy's alone serve the mathematician's purpose.

* The reader should very carefully note that this is not an approximate result, but exact. In all these cases, where limits are dealt with, we are compelled to consider approximate *cases* in order to learn the nature of the final state of things; but our *result* refers to *that* state of things, and not to any intermediate state, *however near*. The reader has missed the essential point of the method of limits if he fails to see this. We have not to deal with approximate *results* at all in thus applying the method of limits. Perhaps the beginner may recognise this truth more clearly if I apply the method to solve a well-known problem. Let it be required to determine the angle ABT, included between a radius AB of the circle BCF (Fig. 2), and the tangent BT at B. Take C a point near B, and draw the secant CBD. Then conceive that C approaches B, carrying the secant along with it. Obviously when C has thus moved up to B, the secant will occupy the position of the tangent BT. Now in any antecedent position, as C in the figure, we have the triangle ABC isosceles; and the equal angles ABC, ACB together, differ from two right angles by the angle A. Hence ABC falls short of a right angle by half the angle A, so that ABD (which together with ABC makes up two right angles) exceeds a right angle by half the angle A. Now when C moves up to B, the angle A diminishes, and ultimately vanishes. Hence the difference between ABD and a right angle ultimately vanishes; so that when the secant CBD has become the

We have then, if

$$y = \sin. x,$$
$$\frac{dy}{dx} = \cos. x.$$

Let us study this result a little.

Remembering that the differential coefficient of a quantity expresses the rate at which the quantity is increasing, we see that the above result implies that as we increase the angle the sine increases, until x is a right angle or $\frac{\pi}{2}$. But after x has passed this value, cos. x is negative. This implies that the sine thenceforth diminishes; and we know as a matter of fact that the sine does diminish as the angle passes the right angle.

Again; notice how the differential coefficient implies the rate of change. We know that cos. x is unity, or has its greatest value, when $x=0$. As x changes from 0 then the sine changes fastest. Again; cos. x is nought when x is a right angle, and very small when x is nearly a right angle. Hence the sine changes very slowly as the angle is passing the right angle. All this, of course, is very obvious without any reference to the differential calculus. But it serves well to illustrate the application of the calculus to more difficult inquiries.

I leave the reader to prove by a similar construction that,

If $y = \cos. x,$

$$\frac{dy}{dx} = -\sin. x.$$

Obviously also, if $y = a \sin. x,$

$$\frac{dy}{dx} = a \cos. x,$$

and if $y = a \cos. x,$

$$\frac{dy}{dx} = -a \sin. x.$$

Our Whist Column.

SIR,—I send you a game from actual play, which I hope will be both interesting and instructive to your readers. I have annotated the play for the benefit of the less experienced players.—Yours, &c.,

FREDERIC H. LEWIS.

Temple.

We commend the following game to the careful study of our numerous Whist students. The play is good throughout, except the mistake on *Y*'s part, to which Mr. Lewis calls attention in his remarks; but *Y*'s intention was excellent, and it was only *A*'s deeper play which foiled it. *Y* had to take several things into account, and he took all points carefully into account except one: viz., that the lead could be thrown into *Z*'s hand. The abundant signalling in the game is worth noticing, as also the way in which *B* omits the usual signal for length in suit headed by Ace, Queen, Knave.

THE HANDS.

A.
Diamonds—Q, 6, 5, 4, 3.
Spades—8, 6.
Hearts—K.
Clubs—Kn, 10, 5, 3, 2.

B.
Diamonds—8.
Spades—10, 5, 4, 2.
Hearts—A, Q, Kn, 9, 6, 2.
Clubs—A, 6.

Y.
Diamonds—K, 7.
Spades—Kn, 7.
Hearts—10, 7, 5, 4, 3.
Clubs—K, Q, 8, 4.

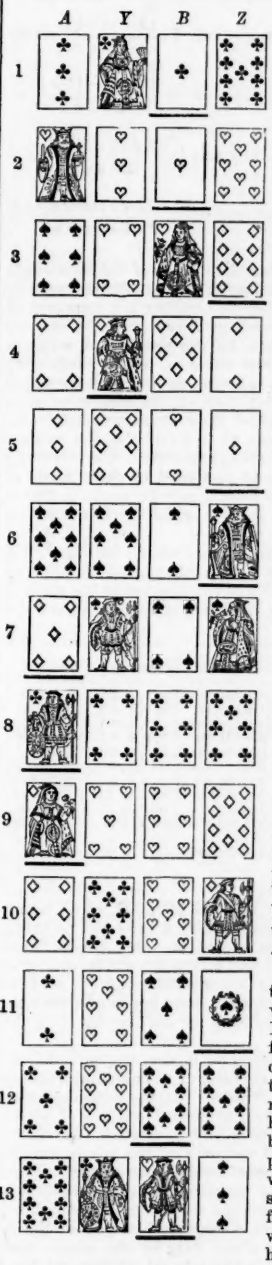
Z.
Diamonds—A, Kn, 10, 9, 2.
Spades—A, K, Q, 9, 3.
Hearts—8.
Clubs—9, 7.

B
Dealer.
Y Z
Trump Card, Diamond Ace.
A

Score:— *A*, *B*, = 4
Y, *Z*, = 4

THE PLAY.

NOTE.—The card underlined wins the trick, and card below leads next round.



REMARKS, INFERENCES, &c.*

1. With five trumps, and five comparatively small cards, *A* properly leads from his plain suit [playing the penultimate, though if the score were different, a trump lead would be permissible, and, according to Pole, advisable, but the rule "always lead a trump from five," is open to question]. The fall of the nine from *Z* shows *A* that *Z* either has no more Clubs or is signalling [unless, which is less likely, *Y* held Queen only; in which case *Z* may have the King, and *B* have four Clubs left.]

2. *B* opens his strong suit.

3. *B*, although he has six Hearts, continues with the Queen, rather than with the Knave [see Leads, &c.] in order that *A*, having dropped the King, may not be in doubt. *A* refuses to overtrump *Z*, because it is clear to him that *Z*'s hand consists of Spades and trumps: he therefore discards a Spade.

4. *Z* sees his Spades in danger, and apparently from the weak hand. He plays, therefore, to find the King in his partner's hand, or finesse on the return. [*A* plays the penultimate trump, showing his partner (next round) that he held five originally.]

5. *Z* is obliged to play the Ace, so as to get the first force on *A* before he establishes his Club suit. [The care with which *Z* attends to this little matter will seem strange to those who think it a Whist offence of the first magnitude to give the enemy a chance of ruffing—they never call it "forcing," by the way—or to fail to give one's partner such a chance. It may be worth their while, if such there be among our readers, for these unwise players to try the effect of *Z*'s omitting to force.]

8. *Y* passes, in the expectation that *A* will continue the Club, in which he maintains the tenace. He thinks if he takes it, he must force *Z* at the risk of his being overtrumped. But he did not take into account that *Z*'s trumps must be Knave, Ten, for if *A* had had the two best, he would probably have drawn the trumps. *Y*'s play was to win the Club, force *Z* with the Heart, thus keeping the second best Club when *A* was forced in return with the Club, so winning the game. *Z* completes his signal.

9 and 10. [Well played, *A*!] The play of *Y* in the last trick lets *A* into the whole of his hand. It is clear to him that *Y* is keeping up the tenace, and that he has not the best Heart. *A*'s play is then very pretty. By playing the Queen of trumps he throws, in the next trick, the lead into *Z*'s hand, taking the chance of finding *B* with a winning spade. The rest of the hand plays itself.

tangent BT, the angle ABT is a right angle. We know this to be not approximately, but exactly true; but the reader must not be satisfied until he sees that the line of reasoning given here *proves* it to be so.

CHANCES OF HOLDING CERTAIN HANDS AT WHIST.—The following calculation will show what is the chance of holding a hand at Whist

* The notes within brackets are by "Five of Clubs."

XUM

in which the cards are distributed among different suits in any possible way:—

1 card or 12 cards may be taken from any suit in 13 ways.

2 or 11 cards may be taken from any suit in $\frac{13\times12}{2}=78$ ways.

3 or 10 cards may be taken from any suit in $\frac{13\times12\times11}{2\times3}=286$ ways.

4 or 9 cards may be taken from any suit in $\frac{13\times12\times11\times10}{2\times3\times4}=715$ ways.

5 or 8 cards may be taken from any suit in $\frac{13\times12\times11\times10\times9}{2\times3\times4\times5}=1287$ ways.

6 or 7 cards may be taken from any suit in $\frac{13\times12\times11\times10\times9\times8}{2\times3\times4\times5\times6}=1716$ ways.

The number of ways in which a complete hand of thirteen cards can be made, having the cards distributed among different suits in a certain way, is obtained by multiplying together the numbers of the ways in which the numbers of cards in the several suits may be taken, and multiplying that product by the number of ways in which the suits can be chosen. For instance, if the cards were divided among the suits thus—1, 3, 4, 5—the number of ways would be $13\times286\times715\times1287\times24$; 24 being $4\times3\times2$, the number of ways of choosing the suits. A hand divided thus—2, 2, 3, 6—might be made in $78\times78\times286\times1716\times12$ ways, 12 or 4×3 being the number of ways in which the suits of 3 and 6 can be chosen, the other two suits having two cards each. A hand composed of three cards of each of three suits and four of the fourth, may be made in $286^3\times715\times4$ ways, there being only four ways in which the four suit can be chosen.

The following table, made in the manner above indicated, will show the chances of holding any sort of hand, the number of chances in each case being one-fourth of the number of the ways in which the hand can be made. The hands are arranged in the order of their respective frequencies:—

Hand.	Chances.	Hand.	Chances.	Hand.	Chances.
4, 4, 3, 2	34,213,221,900	5, 5, 3, 0	1,421,164,602	9, 2, 1, 1	28,275,390
5, 3, 3, 2	24,633,519,768	6, 5, 1, 1	1,119,705,444	9, 3, 1, 0	15,950,220
5, 4, 3, 1	20,527,933,140	6, 5, 2, 0	1,033,574,256	9, 2, 2, 0	13,050,180
5, 4, 2, 2	16,795,581,660	7, 2, 3, 2	814,331,232	7, 6, 0, 0	8,833,968
4, 3, 3, 3	16,726,464,040	7, 4, 1, 1	622,058,580	8, 5, 0, 0	4,969,107
6, 3, 2, 2	8,957,643,552	7, 4, 2, 0	574,207,920	10, 2, 1, 0	1,740,024
6, 4, 2, 1	7,464,702,960	7, 3, 3, 0	421,085,808	9, 4, 0, 0	1,533,675
6, 3, 3, 1	5,474,115,504	8, 2, 2, 1	305,374,212	10, 1, 1, 1	628,342
5, 5, 2, 1	5,038,674,498	8, 3, 1, 1	186,617,574	10, 3, 0, 0	245,388
4, 4, 4, 1	4,761,836,375	8, 3, 2, 0	172,262,376	11, 1, 1, 0	39,546
7, 3, 2, 1	2,985,881,184	7, 5, 1, 0	172,262,376	11, 2, 0, 0	18,252
6, 4, 3, 0	2,105,429,040	6, 6, 1, 0	114,841,584	12, 1, 0, 0	507
5, 4, 4, 0	1,973,839,725	8, 4, 1, 0	71,775,990	13, 0, 0, 0	1

The total number of chances is 158, 753, 389, 900, which is one-fourth of the whole number of ways in which a hand can be made. The chances cannot be exactly expressed in much simpler terms than these—the only factors which will divide the whole number of chances and the chances of any particular hand being 100, and the factors of 100. There are, however, only three hands of which the chances cannot be expressed more simply by dividing by 2, 4, 10, 20, 25, or 100.

If it is desired to know the chance of having any sort of hand with the condition that it shall contain, or not contain, a trump, the rule for determining it is as follows:—If the hand comprises only two suits, one-third of the whole number of chances of having such a hand is the number of chances of having such a hand, one of those suits being trumps; and two-thirds of the whole number of chances is the number of chances of having such a hand without a trump. In a three-suit hand the proportions are reversed, two-thirds of the possible hands containing a trump and one-third not containing one. For, in the case of a two-suit hand, 26 of the 39 cards not in the hand, any one of which may be the trump card, belong to the two other suits, and in the case of a three-suit hand 13 of the 39 cards belong to the other suit. It is equally easy to determine the chance of having a certain hand of which a certain suit shall be trumps, for instance, in a 10, 2, 1, 0 hand, of the whole number of chances of having such a hand, $\frac{3}{13}$ or $\frac{1}{13}$ is the number of chances of having such a hand containing ten trumps, $\frac{11}{39}$ is the number of chances of the hand containing two trumps, and $\frac{12}{39}$ or $\frac{4}{13}$ is the number of chances of the hand containing only one trump. Of course, this applies only to a non-dealer's hand. The dealer being sure to have a trump, the chances of his having such a hand with 10 or 2 trumps, or only 1 trump, are respectively $\frac{1}{13}$, $\frac{8}{13}$, and $\frac{4}{13}$ of the whole number.

ALGERNON BRAY.

Our Chess Column.

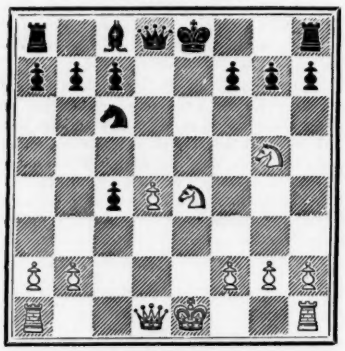
BY MEPHISTO.

GAMES BY CORRESPONDENCE.

(*Continued from p.* 122)

Position after Black 10th move, P takes B:—

BLACK (Chief Editor).



WHITE (Chess Editor).

There can be no doubt about it that Black is now subjected to a strong attack, and we think that the move recommended in our note (*c*) to a game, p. 597 (vol. i.)—viz., B to B4—is much stronger, and ought to yield Black the advantage. In order to test this, a subsidiary game was played between the Editors with the following continuation. Instead of 10. P takes B, 10. B to B4. 11. B to Kt3.

Instead of this move, our correspondent, Leonard P. Rees, thinks that in reply to B to B4, 11. Kt takes BP might be played. This, however, would result in the loss of a piece, *i.e.*:—

11. Kt takes BP	11. K takes Kt
12. Q to KB3 (best)	

(If 12. Q to KR5(ch), then 12. P to KKt3, and White has three pieces attacked.)

	12. Kt takes QP
13. B takes P(ch)	13. K to Ksq

and White must lose a piece.

We resume the subsidiary game, which continued—

	11. B takes Kt
12. Kt takes B	12. P takes Kt
13. B to R4	13. Q to Q4

A good move; it prevents White from taking the Knight and doubling the Pawns, it also prevents P to Q5, and, finally, it may also serve for the purpose of attacking White's Queen's Pawn by R to Qsq.

14. Castles	14. Castles KR
15. B takes Kt	15. Q takes B
16. R to Bsq	16. Q to QKt3

Our Chief Editor says in his note: "The rest of the game requires no comment. Only careful play is needed to ensure Black's winning." The game was continued up to the 32nd move, when White resigned, thereby clearly proving that 10. B to B4 is the proper reply to White's 10th move, KKt to Kt5 (for from the above position, Black (Chief Editor) played, as will be seen, a losing game).

(*To be continued.*)

SOLUTION OF PROBLEM No. 45,

BY B. G. LAWS, p. 63.

1. B takes P	1. K to Q5
2. R to Q2(ch)	2. K moves
3. B takes P, mate	

(*a*).

	1. K to Q6
2. B takes P	2. K to Q5
3. R to Q2, mate	

(*b*).

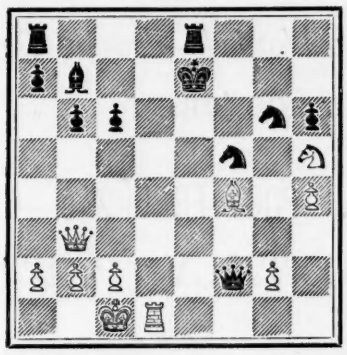
	1. K to B6
2. B takes P(ch)	2. K takes P
3. Kt to K3, mate	

PROBLEM No. 46.

End Position occurring in the Thorold Allgaier attack.

BY LEONARD P. REES.

BLACK.



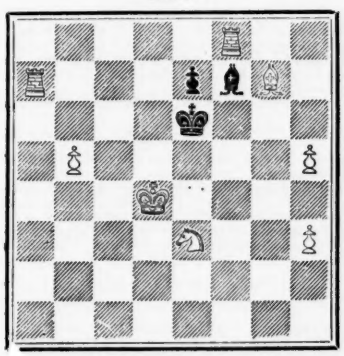
WHITE.

White to play and mate in five moves.

PROBLEM No. 47.

BY "MUZIO."

BLACK.



WHITE.

White to play and mate in three moves.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess-Editor.*

G. W.—Received with thanks. We note the difference in the score.

Leonard P. Rees.—You will find all information you require. We do not forget anything, but we say, Better late than never.

A. Freeman.—1. Drawn game. 2. The same.

Correct solutions of Problem 45 received from G. W., Brenton, Bruin, J. B. B.

Alfred B. Palmer.—Received with thanks. Will be examined.

• THE DIET OF THE JAPANESE.

FEW natives, except officers in the capital, sailors, and soldiers, eat beef. Mutton and pork beyond the treaty ports are scarcely yet known. About two hundred varieties of fish are eaten, one half of the people eating fish every day. The food of the masses is "ninety per cent. vegetable." A list of food-plants in use, not including sea-plants, has been prepared, with their analyses, by Professor Edward Kinch, of the Tokio University. A large number of these substances are unknown, or at least unused, in the United States. Of rice, which occupies in its culture one half of the cultivated land, there are two hundred and fifty varieties of seed in the country. Millet is extensively used, but bread raised from a "sponge" of yeast is scarcely yet known in the popular diet, the old Latin-Portuguese word *pan* being, however, in use.

The soy-bean, which in chemical composition closely approaches animal fibre, is extensively cultivated. Probably no country excels Japan in the variety of leguminous plants raised for food. Of tubers and roots, the sweet potato is the most popular, though, strange to say, as much tabooed by the aristocratic classes as onions are supposed to be among us. Sixteen million bushels of these "Satsuma potatoes" were produced last year, while the "Java," or "Dutch"—our common white potato—is left to foreigners, the native palate not liking it. Lily bulbs—sixteen varieties—serve as food, boiled and served with "drawn butter." The lotus root is eagerly eaten, without oblivion of country or decay of patriotism. Poppy seeds powdered as condiment, infusions of salted cherry blossoms for drink, horse-chestnuts and acorns, are among the articles of diet.

WOMEN'S DRESS.—The amount of air which any one can take into the body at one inspiration is called lung capacity, or vital capacity. The latter term is very significant, implying, as it does, that the working of the whole machinery of life depends upon the air which can be drawn into the lungs. The greater the amount, the better the health, the greater the strength and activity both of mind and body; while, the smaller the amount of air, the less the strength, the poorer the health, the lower the vitality, and the less altogether of bodily power and brain power. Now, I venture to say that not one woman in a thousand has ever attained to, or at present possesses, her full amount of lung or vital capacity. While men, from their youth upwards, have encouraged the development of lung capacity by vigorous exercise, by wearing garments which compress no vital organ, and offer the least possible impediment to muscular activity, women, on the contrary, have taken no vigorous exercise, and worn garments compressing all the vital organs, while offering, at the same time, the greatest amount of impediment and hindrance to muscular activity.—*Mrs. King on "Rational Dress."*

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